HOUSATONIC RIVER BASIN

1997/1998 WATER QUALITY ASSESSMENT REPORT

Housatonic River at Willow Mill Dam near Mead Paper Company in South Lee

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1997/1998 WATER QUALITY ASSESSMENT REPORT

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Division of Watershed Management
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  - Bureau of Waste Prevention
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- Environmental Protection Agency (EPA)
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LIST OF ACRONYMS

7Q10	seven day ten year low flow
ACEC	Areas of Critical Environmental Concern
BMP	best management practice
BPJ	best professional judgement
CFS	cubic feet per second
CMR	Code of Massachusetts Regulations
CNOEC	chronic no observed effect concentration
CWA	Clean Water Act
DDT	Dichlordiphenyltrichloroethane
DEM	Department of Environmental Management
DEP	Department of Environmental Protection
DFWELE	Department of Fisheries, Wildlife, and Environmental Law Enforcement
DMR	Discharge Monitoring Report
DNAPL	Dense Non-Aqueous Phase Liquids
DO	Dissolved oxygen
DPH	Massachusetts Department of Public Health
DWM	Department of Watershed Management
EPA	United States Environmental Protection Agency
GIS (MassGIS)	Geographic Information System
GPM (D)	gallons per minute (day)
LC_{50}	lethal concentration to 50% of the test organisms
MGD	million gallons per day
mg/L	milligram per liter
NCCW	non-contact cooling water
NH_3-N	ammonia-nitrogen
NPDES	National Pollutant Discharge Elimination System
NPS	non point source
NTU	nephelometric turbidity units
ORW	Outstanding Resource Waters
PAH	polyaromatic hydrocarbons
PALIS	Pond and Lake Information System
PCB	polychlorinated biphenols
PPM	parts per million
PWS	Public Water Supply
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/ Quality Control
RBP	Rapid Bioassessment Protocol
SARIS	Stream and River Inventory System
SEC	Sprague Electric Company
SS	suspended solids
SU	standard units
SWQS	Massachusetts Surface Water Quality Standards
TMDL	total maximum daily load
TOC	total organic carbon
TRC	total residual chlorine
USGS	United States Geological Survey
WMA	Water Management Act
WWTP	Waste Water Treatment Plant

EXECUTIVE SUMMARY
HOUSATONIC RIVER BASIN 1997/1998
WATER QUALITY ASSESSMENT REPORT

The Massachusetts Surface Water Quality Standards designate the most sensitive uses for which surface waters in the state shall be protected. The assessment of current water quality conditions is a key step in the successful implementation of the Watershed Approach. This critical phase provides an assessment of whether or not the designated uses are being met (support, partial support, non-support) or are not assessed, as well as basic information needed to focus resource protection and remediation activities later in the watershed management planning process.

PCB contamination from electrical manufacturing companies located in the upper portion of the watershed overshadows all other water quality issues in the Housatonic River Basin. In 1981, Department Environmental Protection (DEP) Bureau of Waste Site Cleanup issued an Administrative Consent Order designating the General Electric (GE) Company Pittsfield and the river as a hazardous waste site because of severe PCB contamination (Steenstrup 1999). Under the Massachusetts Contingency Plan, DEP established multiple priority disposal sites under Massachusetts General Law Chapter 21E. Cleanup activities are ongoing and a cleanup agreement for the river is currently being finalized between GE, the Environmental Protection Agency (EPA), and DEP.

This report presents a summary of water quality conditions in 19 streams (discussed as 23 individual river segments): the mainstem Housatonic River and its branches (Southwest, West and East branches), 15 tributaries including Cleveland, Cady, Windsor, Wahconah Falls, Anthony, Goose Pond, Furnace, Long Pond, Seekonk, Karner and Hubbard brooks and the Williams, Green, and Konkapot River and one unnamed stream and for 32 lakes in the basin. Detailed information for the 23 individual river segments (163.1 river miles) and 32 lakes (4,254 acres) in the Housatonic River Basin is presented in this assessment report. The following is a summary of the *Aquatic Life, Fish Consumption, Primary* and *Secondary Contact Recreation, Shellfishing* and *Aesthetics* uses in these waters.

HOUSATONIC RIVER BASIN - STREAMS

Aquatic Life Use

The *Aquatic Life Use* is supported when suitable habitat (including water quality) is available for sustaining a native, naturally diverse, community of aquatic flora and fauna. Impairment of the *Aquatic Life Use* (non-support or partial support) may result from anthropogenic stressors that include point and/or nonpoint source(s) of pollution and hydrologic modification. The status of the *Aquatic Life Use* in the Housatonic River Basin is as follows:

Aquatic Life Use Summary - Streams

- 57.1 river miles support (5.1 miles threatened)
- 4.8 river miles partial support
- 71.3 river miles non-support
- 29.9 river miles not assessed

The entire length of four streams in the Housatonic River Basin is assessed as fully supporting the *Aquatic Life Use:* Cleveland, Anthony, and Furnace brooks and the Williams River (18.4 miles). Additionally, portions of the East Branch Housatonic River, Cady, Windsor, Wahconah Falls, and Karner brooks and the Konkapot River support the *Aquatic Life Use* (the remaining 38.7 miles) (Figure 1).

The *Aquatic Life Use* is partially supported in the lower 2.0 mile reach of Karner Brook, presumably the result of reduced habitat related to flow alteration, and the lower 2.8 mile reach of the Konkapot River, a result of organic enrichment (Figure 1).

The entire mainstem Housatonic River (53.8 miles) and 15.5 miles of its headwater branches (Southwest, West and East branches) do not support the *Aquatic Life Use* (Figure 1). Causes of impairment are primarily related to PCB contamination associated with the GE Pittsfield Company. Habitat quality degradation (notably severe sedimentation) and impacts associated with paper company wastewater discharges (such as turbidity and settleable solids) were also detected.

Hydromodification (streamflow fluctuations) is considered a threat to the *Aquatic Life Use* for a distance of 5.1 river miles of the mainstem Housatonic River downstream of the Glendale Project hydropower facility. An additional 2.0 river miles of two streams do not support the *Aquatic Life Use* as result of water withdrawals (de-watering or drying of streambeds); a portion of Windsor Brook and the entire length of Long Pond Brook. Water withdrawal practices may also adversely impact as many as nine additional streams downstream of water withdrawals and diversions in the Housatonic River Basin. These streams merit further investigation.

A total of 27.6 river miles, representing the entire length of five streams (Goose Pond, Hubbard, and Seekonk brooks, the Green River, and an unnamed tributary to Hubbard Brook), are not assessed for the *Aquatic Life Use* nor are portions of Cady and Wahconah Falls brooks (2.3 miles).

Fish Consumption Use

The *Fish Consumption Use* is supported when there are no pollutants present that result in unacceptable concentrations in edible portions of marketable fish or shellfish or for the recreational use of fish, shellfish, other aquatic life or wildlife for human consumption. The assessment of this use is made using the most recent list of Fish Consumption Advisories issued by the Massachusetts Executive Office of Health and Human Services, Department of Public Health (DPH), Bureau of Environmental Health Assessment Fish Consumption Advisory List (MA DPH 1999). The DPH list identifies waterbodies where elevated levels of a specified contaminant in edible portions of freshwater species poses a health risk for human consumption; hence the *Fish Consumption Use* is assessed as non-support in these waters. In 1994, DPH also issued a statewide "Interim Freshwater Fish Consumption Advisory" for mercury (MA DPH 1994). This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. DPH's interim advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially. Because of the statewide interim advisory, however, no fresh waters can be assessed as supporting the *Fish Consumption Use*. The Housatonic River PCB fish consumption advisory also recommends that fish taken from feeder streams to the Housatonic River be trimmed of fatty tissue prior to cooking. Since this advisory does not restrict consumption, only preparation methods, this use is not assessed unless an advisory for a specific tributary is in place. The status of the *Fish Consumption Use* in the Housatonic River Basin is as follows:

Fish Consumption Use Summary - Streams

- 71.1 river miles non-support
- 92.0 river miles not assessed

The fish consumption advisory for the Housatonic River has been in place since 1982 because of PCB contamination. The current advisory recommends that the general public should not consume fish, frogs and turtles from the Housatonic River between Dalton and Sheffield that fish taken from feeder streams to the Housatonic River should be trimmed of fatty tissue prior to cooking (MA DPH 1999). Because of this advisory a total of 62.2 river miles (9.4 miles of the East Branch Housatonic River and 52.8 miles of the mainstem Housatonic River) does not support the *Fish Consumption Use*. This advisory also pertains to three lakes: Center Pond, Woods Pond and Risingdale Impoundment (see Housatonic River Basin - Lakes).

DPH also issued a fish consumption advisory for the Konkapot River on 6 February 1998 because of elevated concentrations of mercury (DPH 1999) (Figure 1). The advisory warns children younger than 12 years old, pregnant women and nursing mothers not to eat fish from the Konkapot River from the village of Mill River to the confluence with the Housatonic River. The advisory also recommends that the general public should limit consumption of all fish caught from this reach of the Konkapot River to two meals per month. Therefore, the *Fish Consumption Use* in the Konkapot River is not supported for a total of 8.9 river

miles in Massachusetts (the reach in Connecticut is not covered in this report) due to elevated mercury concentrations of mercury.

Recreational Uses

The *Primary Contact Recreational Use* is supported when conditions are suitable (low fecal coliform bacteria densities) for any recreation or other water activity during which there is prolonged and intimate contact with the water with a significant risk of ingestion. Activities include, but are not limited to, wading, swimming, diving, surfing and water skiing. The status of the *Primary Contact Recreational Use* in the Housatonic River Basin is as follows:

Primary Contact Use Summary - Streams

- 15.9 river miles support
- 2.8 river miles partial support
- 144.4 river miles not assessed

The *Primary Contact Recreational Use* is assessed for only one stream, the Konkapot River, in the Housatonic River Basin, a function of the decision to focus DEP sampling efforts (specifically fecal coliform bacteria) on this river (Figure 1). The upper 15.9 miles of the Konkapot River (from the outlet of Brewer Lake to the Connecticut border) fully supports the *Primary Contact Recreation Use*. The lower 2.8 miles of the river (from the Connecticut border in Sheffield to the confluence with the Housatonic River) partially supports this use due to elevated levels of fecal coliform bacteria.

The *Secondary Contact Recreational Use* is supported when conditions are suitable for any recreation or other water use during which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities. The status of the *Secondary Contact Recreational Use* in the Housatonic River Basin is as follows:

Secondary Contact Use Summary - Streams

- 18.7 river miles support
- 144.4 river miles not assessed

The *Secondary Contact Recreational Use* is also assessed only for the Konkapot River (Figure 1). This use is supported for the entire 18.7 miles.

Aesthetics Use

The *Aesthetics Use* is supported when surface waters are free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life. The status of the *Aesthetics Use* in the Housatonic River Basin is as follows:

Aesthetics Use Summary - Streams

- 95.7 river miles support
- 11.3 river miles partial support
- 11.7 river miles non-support
- 44.4 river miles not assessed

The *Aesthetics Use* is supported for the entire length of six streams (representing 47.4 river miles) in the Housatonic River Basin: Cleveland, Anthony and Karner brooks and the Williams, Green and Konkapot rivers (Figure 1). A total of 18.3 miles representing portions of the East Branch Housatonic River, Cady, Windsor and Wahconah Falls brooks also support the *Aesthetics Use*, while the remaining 10.4 miles of these streams is not assessed.

The only rivers impaired for the *Aesthetics Use* (partial or non-support) include portions of the Southwest and West branches and the mainstem Housatonic River (Figure 1). Causes of impairment include instream turbidity, severe sedimentation, trash/debris, dense mats of algae, and/or objectionable color.

The *Aesthetics Use* for six streams, Goose Pond, Long Pond, Hubbard, Furnace and Seekonk brooks and an unnamed tributary to Hubbard Brook (representing 23.3 river miles) is not assessed.

Summary

The evaluation of current water quality conditions in the Housatonic River Basin streams has revealed the need for: additional monitoring, elimination of impacts from point source pollution (municipal and industrial wastewater discharges), minimization of impacts from water withdrawals (water supplies, diversions, hydropower), and control of nonpoint source pollution. Specific recommendations for each individual river segment are provided in this assessment report.

HOUSATONIC RIVER BASIN - LAKES

Overall use support status and trophic status of the lakes, ponds and impoundments (the term "lakes" will hereafter be used to include all) surveyed in the Housatonic River Basin are presented in Tables 1 and 2, respectively. These data represent approximately 27% (32 of 119) of the lakes/ponds in the Housatonic Basin and about 81% (4,254 of 5,227) of the acreage. It should be noted that lakes or portions of lakes were listed as undetermined when indicators were not readily observable. With this approach, the assessment of lakes in the Housatonic River Basin is limited to a "best case" picture (i.e., only the most obvious impairments are reported). Potentially more of the lake acreage would be listed as impaired or in a more enriched trophic status if more variables were measured and more criteria assessed.

A total of 662 acres of lakes (representing four lakes) in the Housatonic River Basin do not support the *Fish Consumption Use*. A fish consumption advisory for the Housatonic River was issued in 1982 because of PCB contamination. The current advisory recommends that the general public should not consume fish, frogs and turtles from the Housatonic River between Dalton and Sheffield (MA DPH 1999). The *Fish Consumption Use* in three lakes (representing 195 acres) is non-supported due to this advisory: Center Pond in Dalton, Woods Pond in Lee/Lenox, and Risingdale Impoundrnent in Great Barrington.

Additionally, DPH issued a fish consumption advisory for Pontoosuc Lake, Pittsfield/Lanesborough. The advisory recommends that children under 12 years of age, pregnant women, and nursing mothers should not consume fish from the lake because of a mercury hazard and all others should limit consumption of largemouth bass to two (2) meals per month (MA DPH 1999). Based on this advisory, the *Fish Consumption Use* is not supported in Pontoosuc Lake (467 acres). Although the interim statewide health advisory warns that pregnant women should not consume fish from any inland Massachusetts waters, this advisory is not reflected in Table 1.

Table 1. Housatonic River Basin Lakes Use Support Summary surveyed in Summer, 1997 (In Acres).

USE	SUPPORT	PARTIAL SUPPORT	NON-SUPPORT	NOT ASSESSED
Aquatic Life	0	3022	0	1232
Fish Consumption*	0	0	662	3592
Swimmable	0	61	291	3902
Secondary Contact	3829	61	291	73
Aesthetics	3829	61	291	73

* NOTE: In 1994, DPH issued a statewide *Interim Freshwater Fish Consumption Advisory* for mercury. This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. The advisory encompasses all freshwaters in Massachusetts therefore the *Fish Consumption Use* will not be assessed as support.

Table 2. Housatonic River Basin Lakes Trophic Status Summary surveyed in Summer, 1997.

TROPHIC STATUS	NUMBER OF LAKES	ACRES
Oligotrophic	0	0
Mesotrophic	6	1039
Eutrophic	9	1283
Hypereutrophic	0	0
Dystrophic	0	0
Undetermined/ Not Attainable	17	1932
Total	32	4254

Summary

Despite the "best case" scenario that is favored by the Housatonic River Basin lake assessment approach, 28% (representing 30% of the surveyed area) of the lakes showed severe (eutrophic or hypereutrophic) symptoms of succession. Presumably additional testing of dissolved oxygen, chlorophyll, and/or nutrients would corroborate that trophic status conditions are this advanced.

Three non-native, aquatic species (Eurasian water milfoil, European naiad, and curly leaf pondweed) were found in lakes of the Housatonic River Basin. They are particularly invasive species that reproduce vegetatively so they may spread downstream or be transported mechanically between lakes.

Two non-native, wetland species were also observed in Housatonic River Basin lakes. The most frequently occurring non-native wetland species was purple loosestrife. Populations of this plant are common throughout the entire watershed. Its presence was recorded at 44% of the lakes. The other non-native wetland plant noted in the watershed is the reed grass. The two non-native wetland species were co-located at five lakes (Ashmere Lake, Hinsdale, Lake Garfield, Monterey, Greenwater Lake, Becket, Laurel Lake, Lee/Lenox, and Stockbridge Bowl, Stockbridge). The reed grass was found alone at Cookson Pond in New Marlborough and Hayes Pond, Monterey.

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HOUSATONIC RIVER BASIN

1997/1998 DEP DWM Water Quality, macroinvertebrate and fish toxics monitoring station data summary.

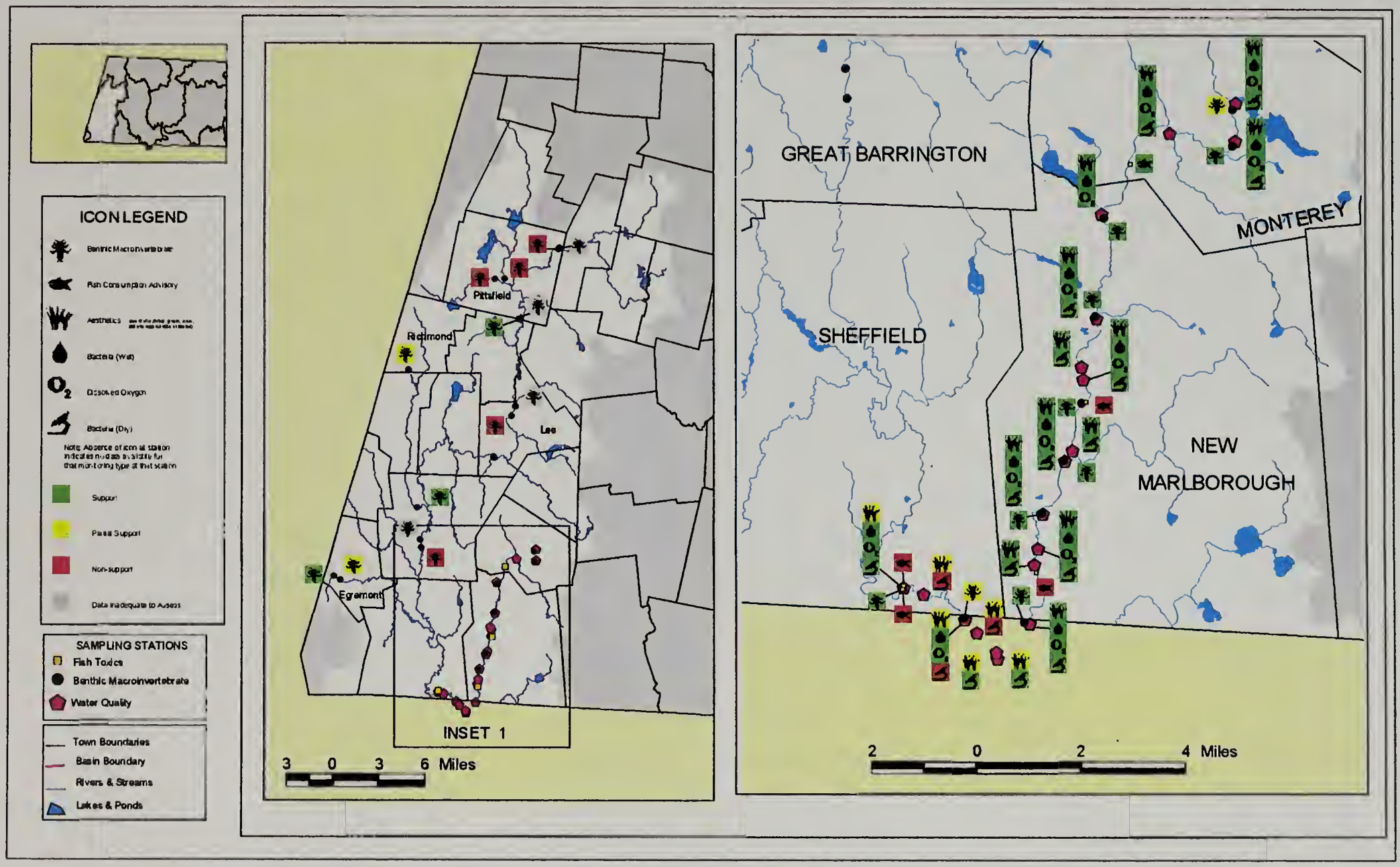

Figure 1. 1997/1998 DEP DWM water quality, macroinvertebrate and fish consumption station data summary in the Housatonic River Basin

INTRODUCTION

The Massachusetts Watershed Initiative is a collaborative effort between state and federal environmental agencies, municipal agencies, citizens, non-profit groups, businesses and industries in the watershed. The mission is to improve water quality conditions and to provide a framework under which the restoration and/or protection of the basin's natural resources can be achieved. Implementation of this project is underway in a process known as the "Watershed Approach". The five-year cycle of the Watershed Approach, as illustrated in Figure 2, provides the management structure to carry out the mission. This report presents the 1997/1998 assessment of water quality conditions in the Housatonic River Basin. The assessment is based on information that has been researched and developed through the first three years (information gathering, monitoring, and assessment) of the five-year cycle by the Department of Environmental Protection (DEP) as part of its federal mandate under the Federal Water Pollution Control Act (commonly known as the Clean Water Act).

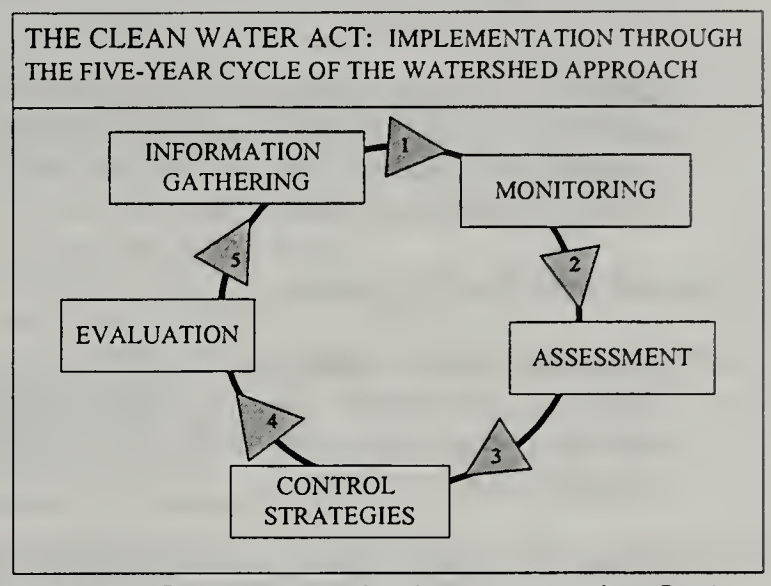

Figure 2. Clean Water Act Implementation Cycle

The objective of the Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters (Environmental Law Reporter 1988). To meet this goal, the CWA requires states to develop information on the quality of the Nation's water resources and report this information to the U.S. Environmental Protection Agency (EPA), the U.S. Congress, and the public. Together, these agencies are responsible for implementation of the CWA mandates. Under Section 305(b) of the Federal Clean Water Act, DEP must submit a statewide report every two years to the EPA, which describes the status of water quality in the Commonwealth. The most recent 305(b) report is the *Commonwealth of Massachusetts Summary of Water Quality 1998* (MA DEP 1998a). The 305(b) statewide report is based on the compilation of information for the Commonwealth's 27 watersheds. The 305(b) report compiles data from a variety of sources, and provides an evaluation of water quality, progress made towards maintaining and restoring water quality, and the extent to which problems remain at the statewide level. At the watershed level, instream biological, habitat, physical/chemical, toxicity data and other information is evaluated to assess the status of water quality conditions. This analysis follows a standardized process described below (Assessment Methodology).

ASSESSMENT METHODOLOGY

WATER QUALITY CLASSIFICATION

The Massachusetts Surface Water Quality Standards designate the most sensitive uses for which the surface waters of the Commonwealth shall be enhanced, maintained and protected; prescribe minimum water quality criteria required to sustain the designated uses; and include provisions for the prohibition of discharges (MA DEP 1996). These regulations undergo public review every three years. These surface waters are segmented and each segment is assigned to one of the six classes described below:

Inland Water Classes

1. ***Class A*** *– These waters are designated as a source of public water supply. To the extent compatible with this use they shall be an excellent habitat for fish, other aquatic life* and *wildlife,* and *suitable for primary* and *secondary contact recreation. These waters shall have excellent aesthetic value. These waters are designated for protection as Outstanding Resource Waters (ORW's) under 314 CMR 4.04(3).*

2. ***Class B*** *– These waters are designated as a habitat for fish, other aquatic life,* and *wildlife,* and *for primary* and *secondary contact recreation. Where designated they shall be suitable as a source of water supply with appropriate treatment. They shall be suitable for irrigation* and *other agricultural uses* and *for compatible industrial cooling* and *process uses. These waters shall have consistently good aesthetic value.*

3. ***Class C*** *– These waters are designated as a habitat for fish, other aquatic life* and *wildlife,* and *for secondary contact recreation. These waters shall be suitable for the irrigation of crops used for consumption after cooking* and *for compatible industrial cooling* and *process uses. These waters shall have good aesthetic value.*

Coastal and Marine Classes

4. ***Class SA*** *– These waters are designated as an excellent habitat for fish, other aquatic life* and *wildlife* and *for primary* and *secondary recreation. In approved areas they shall be suitable for shellfish harvesting without depuration (Open Shellfishing Areas). These waters shall have excellent aesthetic value.*

5. ***Class SB*** *– These waters are designated as a habitat for fish, other aquatic life* and *wildlife* and *for primary* and *secondary contact recreation. In approved areas they shall be suitable for shellfish harvesting with depuration (Restricted Shellfishing Areas). These waters shall have consistently good aesthetic value.*

6. ***Class SC*** *– These waters are designated as a habitat for fish, other aquatic life,* and *wildlife* and *for secondary contact recreation. They shall also be suitable for certain industrial cooling* and *process uses. These waters shall have good aesthetic value.*

The CWA Section 305(b) water quality reporting process is an essential aspect of the Nation's water pollution control effort. It is the principal means by which EPA, Congress, and the public evaluate existing water quality, assess progress made in maintaining and restoring water quality, and determine the extent of remaining problems. In so doing, the States report on waterbodies within the context of meeting their designated uses (described above in each class). Each class is identified by the most sensitive, and therefore governing, water uses to be achieved and protected. These uses include: *Aquatic Life, Fish Consumption, Drinking Water, Primary* and *Secondary Contact Recreation, Shellfishing* and *Aesthetics.* Three subclasses of Aquatic Life are also designated in the standards: Cold Water Fishery (capable of sustaining a year-round population of cold water aquatic life such as trout), Warm Water Fishery (waters which are not capable of sustaining a year-round population of cold water aquatic life), and Marine Fishery (suitable for sustaining marine flora and fauna).

A summary of the state water quality standards (Table 3) prescribes minimum water quality criteria to sustain the designated uses. Furthermore these standards describe the hydrological conditions at which water quality criteria must be met (MA DEP 1996). In rivers and streams, the lowest flow conditions at and above which criteria must be met is the lowest mean flow for seven consecutive days to be expected once in ten years (7Q10). In artificially regulated waters, the lowest flow conditions at which criteria must be met is the flow equal or exceeded 99% of the time on a yearly basis or another equivalent flow which has been agreed upon. In coastal and marine waters and for lakes and ponds the most severe hydrological condition is determined by DEP on a case by case basis.

The availability of appropriate and reliable scientific data and technical information is fundamental to the 305(b) reporting process. It is EPA policy (EPA Order 5360.1 CHG 1) that any organization performing work for or on behalf of EPA establish a Quality System to support the development, review, approval, implementation, and assessment of data collection operations. To this end, DEP describes its Quality System in an EPA-approved Quality Management Plan to ensure that environmental data collected or compiled by the Agency are of known and documented quality and are suitable for their intended use. For external sources of information, DEP requires the following: 1) an appropriate *Quality Assurance Project Plan* including a QA/QC plan, 2) use of a state certified lab (certified in the applicable analysis), 3) data management QA/QC be described, and 4) the information be documented in a citable report.

Table 3. Summary of Massachusetts Surface Water Quality Standards (MADEP 1996). *Note: Italics are direct quotations.*

Dissolved Oxygen	Class A, BCWF*, SA : ≥ 6.0 mg/L and ≥ 75% saturation unless background conditions are lower Class BWWF**, SB: ≥ 5.0 mg/L and ≥ 60% saturation unless background conditions are lower Class C: Not ≤ 5.0 mg/L for more than 16 of any 24 –hour period and not ≤ 3.0 mg/L anytime unless background conditions are lower; levels cannot be lowered below 50% saturation due to a discharge Class SC: Not ≤ 5.0 mg/L for more than 16 of any 24 –hour period and not ≤ 4.0 mg/L anytime unless background conditions are lower; and 50% saturation; levels cannot be lowered below 50% saturation due to a discharge
Temperature	Class A: ≤ 68°F (20°C) and Δ 1.5°F (0.8°C) for Cold Water and ≤ 83°F (28.3°C) and Δ 1.5°F (0.8°C) for Warm Water Class BCWF: ≤ 68°F (20°C) and Δ3°F (1.7°C) due to a discharge Class BWWF: ≤ 83°F (28.3°C) and Δ3°F (1.7°C) in lakes, Δ5°F (2.8°C) in rivers Class C, SC: ≤85°F (29.4°C) nor Δ5°F (2.8°C) due to a discharge Class SA: ≤85°F (29.4°C) nor a maximum daily mean of 80°F (26.7°C) and Δ1.5°F (0.8°C) Class SB: ≤85°F (29.4°C) nor a maximum daily mean of 80°F (26.7°C) and Δ1.5°F (0.8°C) between July through September and Δ 4.0°F (2.2°C) between October through June
pH	Class A, BCWF, BWWF: 6.5 – 8.3 and Δ0.5 outside the background range. Class C: 6.5 – 9.0 and Δ1.0 outside the naturally occurring range. Class SA, SB: 6.5 – 8.5 and Δ0.2 outside the normally occurring range. Class SC: 6.5 – 9.0 and Δ0.5 outside the naturally occurring range.
Fecal Coliform Bacteria	Class A: an arithmetic mean of < 20 organisms /100 ml in any representative set of samples and < 10% of the samples > 100 organisms/100 ml. Class B: a geometric mean of < 200 organisms /100 ml in any representative set of samples and < 10% of the samples > 400 organisms /100 ml. (This criterion can be applied on a seasonal basis at the discretion of the DEP.) Class C: a geometric mean of < 1000 organisms /100ml, and < 10% of the samples > 2000 organisms/100 ml. Class SA: approved Open Shellfish Areas: a geometric mean (MPN method) of < 14 organisms/100 ml and < 10% of the samples > 43 organisms/100 ml (MPN method). Waters not designated for shellfishing: < a geometric mean of 200 organisms in any representative set of samples, and < 10% of the samples > 400 organisms /100 ml. (This criterion can be applied on a seasonal basis at the discretion of the DEP.) Class SB: approved Restricted Shellfish Areas: < a fecal coliform median or geometric mean (MPN method) of 88 organisms/100 ml and < 10% of the samples > 260 organisms /100 ml (MPN method). Waters not designated for shellfishing: < a geometric mean of 200 organisms in any representative set of samples, and < 10% of the samples > 400 organisms /100 ml. (This criterion can be applied on a seasonal basis at the discretion of the DEP.) Class SC: < a geometric mean of 1000 organisms/100 ml and < 10% of the samples > 2000 organisms/100ml
Solids	All Classes: *These waters shall be free from floating, suspended,* and *settleable solids in concentrations or combinations that would impair any use assigned to each class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.*
Color and Turbidity	All Classes: *These waters shall be free from color* and *turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use.*
Oil & Grease	Class A, SA: *Waters shall be free from oil* and *grease, petrochemicals* and *other volatile or synthetic organic pollutants.* Class SA: *Waters shall be free from oil* and *grease* and *petrochemicals.* Class B, C,SB, SC: *Waters shall be free from oil* and *grease, petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course or are deleterious or become toxic to aquatic life.*
Taste and Odor	Class A, SA: *None other than of natural origin.* Class B, C,SB, SC: *None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to each class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.*
Aesthetics	All Classes: *All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.*
Toxic Pollutants ~	All Classes: *All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife… The division shall use the recommended limit published by EPA pursuant to 33 USC 1251, 304(a) as the allowable receiving water concentrations for the affected waters unless a site-specific limit is established.*
Nutrients	*Shall not exceed the site-specific limits necessary to control accelerated or cultural eutrophication.*

*Class BCWF = Class B Cold Water Fishery, ** Class BWWF = Class B Warm Water Fishery, Δ criterion (referring to a change from ambient) is applied to the effects of a permitted discharge. ~ USEPA. 19 November 1999. Federal Register Document. [Online]. United States Environmental Protection Agency. http://www.epa.gov/fedrgstr/EPA-WATER/1998/December/Day-10/w30272.htm.

EPA provides guidelines to the States for making their use support determinations (EPA 1997). The determination of whether or not a waterbody supports each of its designated uses is a function of the type(s), quality and quantity of available current information. Each designated use within a given segment is individually assessed as 1) ***support***, 2) ***partial support***, or 3) ***non- support***. The term *threatened* is used when the use is fully supported but may not support the use within two years because of adverse pollution trends or anticipated sources of pollution. When too little current data/information exists or no reliable data are available the use is ***not assessed***. Although data/information older than five years are usually considered "historical" and used for descriptive purposes, they can be utilized in the use support determination providing they are known to reflect the current conditions. While the water quality standards (Table 3) prescribe minimum water quality criteria to sustain the designated uses, numerical criteria are not available for every indicator of pollution. Best available guidance in the literature may be applied in lieu of actual numerical criteria (e.g., freshwater sediment data may be compared to *Guidelines for the Protection* and *Management of Aquatic Sediment Quality in Ontario* 1993 by D. Persaud, R. Jaagumagi and A. Hayton).

DESIGNATED USES

The Massachusetts Surface Water Quality Standards designate the most sensitive uses for which the surface waters of the Commonwealth shall be enhanced, maintained and protected. Each of these uses is briefly described below (MA DEP 1996):

- AQUATIC LIFE - suitable habitat for sustaining a native, naturally diverse, community of aquatic flora and fauna. Three subclasses of aquatic life are also designated in the standards for freshwater bodies; *Cold Water Fishery* - capable of sustaining a year-round population of cold water aquatic life such as trout, *Warm Water Fishery* - waters which are not capable of sustaining a year-round population of cold water aquatic life, and *Marine Fishery* - suitable for sustaining marine flora and fauna.

- FISH CONSUMPTION - pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or shellfish or for the recreational use of fish, shellfish, other aquatic life or wildlife for human consumption.

- DRINKING WATER - used to denote those waters used as a source of public drinking water. They may be subject to more stringent regulation in accordance with the Massachusetts Drinking Water Regulations (310 CMR 22.00). These waters are designated for protection as Outstanding Resource Waters under 314 CMR 4.04(3).

- PRIMARY CONTACT RECREATION - suitable for any recreation or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water. These include, but are not limited to, wading, swimming, diving, surfing and water skiing.

- SECONDARY CONTACT RECREATION - suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities.

- AESTHETICS - all surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.

- AGRICULTURAL AND INDUSTRIAL - suitable for irrigation or other agricultural process water and for compatible industrial cooling and process water.

The guidance used to assess the *Aquatic Life, Fish Consumption, Drinking Water, Primary* and *Secondary Contact Recreation* and *Aesthetics* uses follows.

AQUATIC LIFE USE

This use is suitable for sustaining a native, naturally diverse, community of aquatic flora and fauna. The results of biological (and habitat), toxicological, and chemical data are integrated to assess this use. The nature, frequency, and precision of the DEP's data collection techniques dictate that a weight of evidence be used to make the assessment, with biosurvey results used as the final arbiter of borderline cases. The following chart provides an overview of the guidance used to assess the status (support, partial support, non-support) of the *Aquatic Life Use*:

Variable (# indicates reference)	***Support***—Data available clearly indicates support. Minor excursions from chemical criteria (Table 3) may be tolerated if the biosurvey results demonstrate support.	***Partial Support*** – Uncertainty about support in the chemical or toxicity testing data, or there is some minor modification of the biological community. Excursions not frequent or prolonged.	***Non-Support*** – There are frequent or severe violations of chemical criteria, presence of acute toxicity, or a moderate or severe modification of the biological community.
BIOLOGY			
Rapid Bioassessment Protocol (RBP) II or III (4)	Non-Impaired	Slightly Impaired	Moderately or Severely Impaired
Fish Community (4)	Best Professional Judgement (BPJ)	BPJ	BPJ
Habitat and Flow (4)	BPJ	BPJ	Dewatered Streambed due to artificial regulation or channel alteration
Macrophytes (4)	BPJ	Non-native plant species present, but not dominant, BPJ	Non-native plant species dominant, BPJ
Plankton/ Periphyton (4)	No algal blooms	Occasional algal blooms	Persistent algal blooms
TOXICITY TESTS			
Water Column (4)	>75% survival either 48 hr or 7-day exposure	>50 - ≤75% survival either 48 hr or 7-day exposure	≤50% survival either 48 hr or 7-day exposure
Effluent (4)	Meets permit limits	(NOTE: if limit is not met, the stream is listed as threatened for 1.0 river mile downstream from the discharge.)	
Sediment (4)	>75% survival	>50 - ≤75% survival	≤50% survival
CHEMISTRY- WATER			
DO (3, 6)	Criteria (Table 3)	Criteria exceed in 11-25% of measurements.	Criteria exceeded >25% of measurements.
pH (3, 6)	Criteria (Table 3)	Criteria exceed in 11-25% of measurements.	Criteria exceeded >25% of measurements.
Temperature (3, 6) [1]	Criteria (Table 3), [1]	Criteria exceed in 11-25% of measurements.	Criteria exceeded >25% of measurements.
Turbidity (4)	Δ 5 NTU due to a discharge	BPJ	BPJ
Suspended Solids (4)	25 mg/L max., Δ10 mg/L due to a discharge	BPJ	BPJ
Nutrients (3) Phosphate-P (4)	Table 1, (Site-Specific Criteria; Maintain Balanced Biocommunity, no pH/DO violations)	BPJ	BPJ
Toxic Pollutants (3, 6) Ammonia-N (3, 4) Chlorine (3, 6)	Criteria (Table 3) 0.254 mg/L NH_3-N [2] 0.011 mg/L TRC	BPJ	Criterion is exceed in > 10% of samples.
CHEMISTRY – SEDIMENT			
Toxic Pollutants (5)	≤ L-EL[3], Low Effect Level	One pollutant between L-EL and S-EL	One pollutant ≥ S-EL (severe)
Nutrients (5)	≤ L-EL	between L-EL and S-EL	≥ S-EL
Metal Normalization to Al or Fe (4)	Enrichment Ratio ≤ 1	Enrichment Ratio >1 but ≤10	Enrichment Ratio ≥10
CHEMISTRY- EFFLUENT			
Compliance with permit limits (4)	In-compliance with all limits	NOTE: If the facility is not in compliance with their permit limits, the information is used to threaten one river mile downstream from the discharge.	
CHEMISTRY-TISSUE			
PCB – whole fish (1)	≤500 µg/kg wet weight	BPJ	BPJ
DDT (2)	≤14.0 µg/kg wet weight	BPJ	BPJ
PCB in aquatic tissue (2)	≤0.79 ng TEQ/kg wet weight	BPJ	BPJ

[1]maximum daily mean T in a month (min 6 measurements evenly distributed over 24-hours) <criterion, [2]Ammonia levels for pH of 9.0, actual "criterion" varies with pH and is evaluated case-by-case. [3]For the purpose of this report, the S-EL for total PCB in sediment (which varies with TOC content) with 1% TOC is 5.3 PPM while a sediment sample with 10% TOC is 53ppm.

Note: The National Academy of Sciences/National Academy of Engineering (NAS/NAE) guideline for maximum organochlorine concentrations (i.e., total PCB) in fish tissue for the protection of fish-eating wildlife is 500µg/kg wet weight (PPB, not lipid-normalized). PCB data (tissue) in this report are presented in µg/kg wet weight (PPB) and are not lipid-normalized to allow for direct comparison to the NAS/NAE guideline.

FISH CONSUMPTION USE

Pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or shellfish or for the recreational use of fish, shellfish, other aquatic life or wildlife for human consumption. The assessment of this use is made using the most recent list of Fish Consumption Advisories issued by the Massachusetts Executive Office of Health and Human Services, Department of Public Health (DPH), Bureau of Environmental Health Assessment Fish Consumption Advisory List (MA DPH 1999). The DPH list identifies waterbodies where elevated levels of a specified contaminant in edible portions of freshwater species poses a health risk for human consumption; hence the *Fish Consumption Use* is assessed as non-support in these waters. In 1994, DPH also issued a statewide "Interim Freshwater Fish Consumption Advisory" for mercury (MA DPH 1994). This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. DPH's interim advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially. Because of the statewide interim advisory, however, no fresh waters can be assessed as supporting the *Fish Consumption Use*. The following is an overview of the guidance used to assess the status (support, partial support, non-support) of the *Fish Consumption Use*.

Variable (# indicates reference)	***Support*** —No restrictions or bans in effect	***Partial Support*** – A "restricted consumption" fish advisory is in effect for the general population or a sub-population that could be at potentially greater risk (e.g., pregnant women, and children	***Non-Support*** – A "no consumption" advisory or ban in effect for the general population or a sub-population for one or more fish species; or there is a commercial fishing ban in effect
DPH Fish Consumption Advisory List (8)	Not applicable, precluded by statewide advisory (Hg)	Not applicable	Waterbody on DPH Fish Consumption Advisory List *

*NOTE: The Housatonic River PCB fish consumption advisory also recommends that fish taken from feeder streams to the Housatonic River be trimmed of fatty tissue prior to cooking. Since this advisory does not restrict consumption, only preparation methods, the *Fish Consumption Use* is not assessed unless a site-specific advisory is in place.

DRINKING WATER USE

The Drinking Water Use denotes those waters used as a source of public drinking water. These waters may be subject to more stringent regulation in accordance with the Massachusetts Drinking Water Regulations (310 CMR 22.00). They are designated for protection as Outstanding Resource Waters in 314 CMR 4.04(3). This use is assessed by DEP's Drinking Water Program (DWP). Below is EPA's guidance used to assess the status (support, partial support, non-support) of the drinking water use.

Variable (# indicates reference)	***Support***-- No closures or advisories (no contaminants with confirmed exceedences of MCLs, conventional treatment is adequate to maintain the supply).	***Partial Support*** – Is one or more advisories or more than conventional treatment is required	***Non-Support*** – One or more contamination-based closures of the water supply
Drinking Water Program (DWP) Evaluation	Reported by DWP	Reported by DWP	Reported by DWP

PRIMARY CONTACT RECREATIONAL USE

This use is suitable for any recreational or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water (1 April to 15 October). These include, but are not limited to, wading, swimming, diving, surfing and water skiing. The chart below provides an overview of the guidance used to assess the status (support, partial support, non-support) of the *Primary Contact Use*.

Variable (# indicates reference)	***Support***– Criteria are met, no aesthetic conditions that preclude the use	***Partial Support*** –Criteria exceeded intermittently (neither frequent nor prolonged), marginal aesthetic violations	***Non-Support*** –Frequent or prolonged violations of criteria, formal bathing area closures, or severe aesthetic conditions that preclude the use
Fecal Coliform Bacteria (3, 9) *	Criteria met OR Dry Weather Guidance <5 samples–≤400/100 ml maximum Wet Weather Guidance Dry weather samples meet and wet samples ≤2000/100 ml	Guidance exceeded in 11-25% of the samples OR Wet Weather Dry weather samples meet and wet samples ≥2000/100 ml	Guidance exceeded in > 25% of the samples
pH (3, 6)	Criteria exceeded in ≤10 % of the measurements	Criteria exceeded in 11-25% of the measurements	Criteria exceeded in >25% of the measurements
Temperature (3)	Criteria met	Criteria exceeded 11-25% of the time	Criteria exceeded 25% of the time
Color and Turbidity (3, 6)	Δ 5 NTU (due to a discharge) exceeded in <10 % of the measurements	Guidance exceeded in 11-25% of the measurements	Guidance exceeded in >25% of the measurements
Secchi disk depth (10) **	Lakes - ≥1.2 meters (≥ 4')	Infrequent excursions from the guidance	Frequent and/or prolonged excursions from the guidance
Oil & Grease (3)	Criteria met	Criteria exceeded 11-25% of the time	Criteria exceeded >25% of the time
Aesthetics (3) Biocommunity (4)**	No nuisance organisms that render the water aesthetically objectionable or unusable; Lakes – cover of macrophytes < 50% of lake area at maximum extent of growth.	Lakes – cover of macrophytes 50-75% of lake area at their maximum extent of growth.	Lakes – cover of macrophytes >75% of lake area at their maximum extent of growth.

Note: Excursions from criteria due to natural conditions are not considered impairment of use.

* Fecal Coliform bacteria interpretations require additional information in order to apply this use assessment guidance. Bacteria data results (fecal coliform) are interpreted according to whether they represent dry weather or wet weather (stormwater runoff) conditions. Accordingly, it is important to interpret the amount of precipitation received in the study region immediately prior to sampling and streamflow conditions.

** Lakes exhibiting impairment of the primary contact recreation use (swimmable) because of macrophyte cover and/or transparency (Secchi disk depth) are assessed as either *partial* or *non-support*. If no fecal coliform bacteria data are available and the lake (entirely or in part) met the transparency (Secchi disk depth) and aesthetics guidance this use is *not assessed*.

SECONDARY CONTACT RECREATIONAL USE

This use is suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities. Following is an overview of the guidance used to assess the status (support, partial support, non-support) of the *Secondary Contact Use.*

Variable (# indicates reference)	***Support***– Criteria are met, no aesthetic conditions that preclude the use	***Partial Support*** –Criteria exceeded intermittently (neither frequent nor prolonged), marginal aesthetic violations	***Non-Support*** –Frequent or prolonged violations of criteria, or severe aesthetic conditions that preclude the use
Fecal Coliform Bacteria (4) *	Dry Weather Guidance <5 samples–≤2000/100 ml maximum >5 samples–≤1000/100 ml geometric mean ≤ 10% samples ≥2000/100 ml Wet Weather Guidance Dry weather samples meet and wet samples ≤4000/100 ml	Wet Weather Guidance Dry weather samples meet and wet samples ≥4000/100 ml	Criteria exceeded in dry weather
Oil & Grease (3)	Criteria met	Criteria exceeded 11-25% of the time	Criteria exceeded >25% of the time
Aesthetics (3) Biocommunity (4) **	No nuisance organisms that render the water aesthetically objectionable or unusable; Lakes – cover of macrophytes < 50% of lake area at their maximum extent of growth.	Macrophyte cover is between 50 – 75%	Macrophyte cover exceeds 75% of the lake area.

Note: Excursions from criteria due to natural conditions are not considered impairment of use.

* Fecal Coliform bacteria interpretations require additional information in order to apply this use assessment guidance. Bacteria data results (fecal coliform) are interpreted according to whether they represent dry weather or wet weather (stormwater runoff) conditions. Accordingly it is important to interpret the amount of precipitation received in the subject region immediately prior to sampling and streamflow conditions.

** In lakes if no fecal coliform data are available, macrophyte cover is the only criterion used to assess the *Secondary Contact Recreational Use*.

For the *Primary* and *Secondary Contact Recreational* uses the following steps are taken to interpret the fecal coliform bacteria results:

1. Identify the range of fecal coliform bacteria results,
2. Calculate the geometric mean (monthly, seasonally, or on dataset), (Note: the geometric mean is only calculated on datasets with >5 samples collected within a 30-day period.)
3. Calculate the % of sample results exceeding 400 cfu/100 mls,
4. Determine if the samples were collected during wet or dry weather conditions (review precipitation and streamflow data),

   Dry weather can be defined as: No/trace antecedent (to the sampling event) precipitation that causes more than a slight increase in stream flow.

   Wet weather can be defined as: Precipitation antecedent to the sampling event that results in a marked increase in stream flow.
5. Apply the following to interpret dry weather data:

   ≤10% of the samples exceed criteria (step 2 and 3, above) assessed as Support,

   11-25% of the samples exceed criteria (step 2 and 3, above) assessed as Partial Support,

   >25% of the samples exceed criteria (step 2 and 3, above) assessed as Non-Support.

AESTHETICS USE

All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life. The aesthetic use is closely tied to the public health aspects of the recreational uses (swimming and boating). Below is an overview of the guidance used to assess the status (support, partial support, non-support) of the *Aesthetics Use*.

Variable (# indicates reference)	***Support*** – 1. No objectionable bottom deposits, floating debris, scum, or nuisances; 2. objectionable odor, color, taste or turbidity, or nuisance aquatic life	***Partial Support*** - Objectionable conditions neither frequent nor prolonged	***Non-Support*** – Objectionable conditions frequent and/or prolonged
Aesthetics (3)* Visual observation (4)	Criteria met	BPJ (spatial and temporal extent of degradation)	BPJ (extent of spatial and temporal degradation

* For lakes, the aesthetic use category is generally assessed at the same level of impairment as the more severely impaired recreational use category (*Primary* or *Secondary Contact*).

SHELLFISHING USE

This use is applicable to coastal waters and is assessed using information from the Department of Fisheries, Wildlife and Environmental Law Enforcement's Division of Marine Fisheries (DMF). The information is in the form of various classifications of shellfish closures and restrictions. Shellfish areas under management orders are not assessed.

Variable (# indicates reference)	***Support*** – SA Waters—open for shellfish harvesting without depuration (Open areas) SB Waters—open for shellfish harvesting with depuration (Open, conditionally approved, restricted areas)	***Partial Support*** – SA Waters—Seasonally closed/open, conditionally approved and restricted SB Waters—Seasonally closed, seasonally open, conditionally restricted areas	***Non-Support*** –SA Waters—Closed areas SB Waters—Closed areas
Division of Marine Fisheries Shellfish Project *Classification* Area Information (11)	Reported by DMF	Reported by DMF	Reported by DMF

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HOUSATONIC RIVER BASIN DESCRIPTION AND CLASSIFICATION

DESCRIPTION

The Housatonic Basin (Figure 3) is located in southwestern Massachusetts. It is bordered by the Hoosic River Basin to the north, the Westfield River Basin to the northeast and by the Farmington River Basin to the southeast. The south and west portions of the basin are bordered by the states of Connecticut and New York, respectively. The Housatonic River originates at the confluence of the West and Southwest Branches of the Housatonic River in Pittsfield. The West Branch Housatonic River originates at the outlet of Pontoosuc Lake in Lanesborough and Pittsfield and the Southwest Branch originates from Richmond Pond in the town of Richmond. The East Branch Housatonic River, which originates from Muddy Pond in the town of Washington, soon joins the mainstem Housatonic River. From Pittsfield, the river flows south for 150 miles (approximately 54 river miles in Massachusetts) until it empties into Long Island Sound near Bridgeport, Connecticut. Other major tributaries to the Housatonic River in Massachusetts include the Williams, Green and Konkapot Rivers and Hubbard Brook.

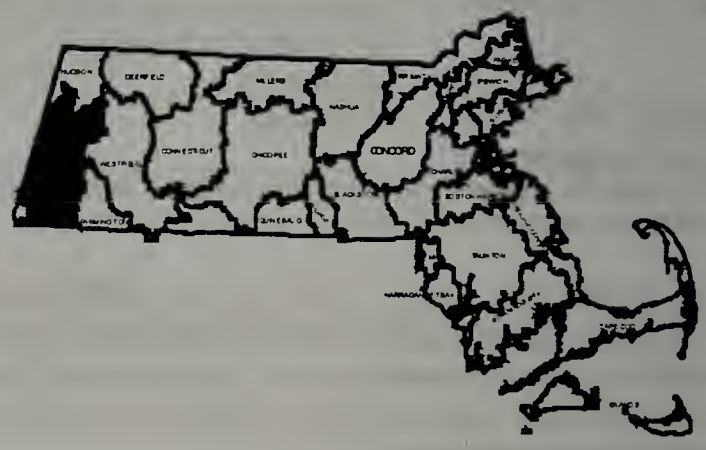


Figure 3. Housatonic River Basin Location.

The drainage basin of the Massachusetts portion of the Housatonic River encompasses 545 square miles, and is located entirely in Berkshire County. The communities of Alford, Becket, Cheshire, Dalton, Egremont, Great Barrington, Hancock, Hinsdale, Lanesborough, Lee, Lenox, Monterey, Mount Washington, New Ashford, New Marlborough, Otis, Peru, Pittsfield, Richmond, Sandisfield, Sheffield, Stockbridge, Tyringham, Washington, West Stockbridge, and Windsor lie wholly or in part within the basin boundaries.

Much of the upper third of the Housatonic River Basin is urbanized, with the city of Pittsfield being the major urban area. The remaining two-thirds of the watershed is primarily rural; large portions of the basin are undeveloped as forest or large wetland systems. The major industries of this region are paper manufacturing and tourism, and both industries have traditionally supported the economy of the area.

The major industrial discharges of wastewater to the river include Crane Paper Company, General Electric Company, Schweitzer-Mauduit International, Inc. and Mead Paper Company; all of these companies provide treatment for their process wastewater prior to discharge to the river. Major municipal wastewater treatment plants are located at Pittsfield, Lenox, Lee, Stockbridge, and Great Barrington. One additional municipal wastewater treatment plant, the West Stockbridge WWTP, discharges into the Williams River. Nonpoint source pollution that is associated with storm water runoff and failing septic systems is also known to contribute to the basin's water quality problems. Urbanization around lakes and ponds has lead to increased loadings of sediment and nutrients, resulting in eutrophication of these waterbodies.

While water quality problems within the basin include eutrophication due to phosphorous loading, sediment and fecal coliform bacteria, these problems have been overshadowed by the PCB contamination from electrical manufacturing in the upper portion of the watershed.

A total of 119 lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) have been identified and assigned PALIS (Pond and Lake Information System) code numbers in the Housatonic River Basin (Ackerman 1989). Ninety-six of the lakes are less than or equal to 50 acres in total surface area; 51 are less than or equal to ten acres. The total surface area of the Housatonic Watershed lakes is 5,227 acres.

CLASSIFICATION

Consistent with the National Goal Uses of "fishable and swimmable waters", the classification of waters in the Housatonic River Basin according to the SWQS, include the following (MA DEP 1996):

Class A Public Water Supplies in the Housatonic River Basin:

- Karner Brook, entire length
- Unnamed Reservoir (East Mountain Reservoir), source to outlet in Great Barrington and those tributaries thereto
- Long Pond, source to outlet in Great Barrington and those tributaries thereto
- Belmont Reservoir, source to outlet in Hinsdale and those tributaries thereto
- Lower Reservoir (Codding Brook Lower Reservoir, Vanetti Reservoir), source to outlet in Lee and those tributaries thereto
- Upper Reservoir (Codding Brook Upper Reservoir, Leahey Reservoir), source to outlet in Lee and those tributaries thereto
- Basin Pond (Washington Mountain Brook Reservoir), source to outlet in Lee and those tributaries thereto
- Lenox Reservoir, source to outlet in Lenox and those tributaries thereto
- Upper Lenox Reservoir, source to outlet in Lenox and those tributaries thereto
- Ashley Lake, source to outlet in Washington and those tributaries thereto
- Sandwash Reservoir, source to outlet in Washington and those tributaries thereto
- Farnham Reservoir, source to outlet in Washington and those tributaries thereto
- Upper Sackett Reservoir (Sackett Reservoir), Reservoir to outlet in Hinsdale and those tributaries thereto
- Lower Sackett Reservoir, source to outlet in Hinsdale and those tributaries thereto
- Cleveland Brook Reservoir, source to outlet in Hinsdale and those tributaries thereto
- Lake Averic (Echo Lake, Mountain Mirror Lake), source to outlet in Stockbridge and those tributaries thereto
- Egypt Reservoir (Egypt Brook Reservoir), Reservoir to outlet in Dalton and those tributaries thereto
- Windsor Reservoir (Cady Brook Reservoir), Reservoir to outlet in Windsor and those tributaries thereto
- Anthony Pond (Anthony Brook Reservoir), Pond to outlet in Dalton and those tributaries thereto
- Ashley Reservoir, Reservoir to outlet in Dalton and those tributaries thereto

In the Housatonic River Basin, all designated ORWs are associated with the Class A waters (Rojko *et al.* 1995). The designation of ORW is applied to those waters with exceptional socio-economic, recreational, ecological and/or aesthetic values. ORWs have more stringent requirements than other waters because the existing use is so exceptional or the perceived risk of harm is such that no lowering of water quality is permissible. ORWs include certified vernal pools and all designated *Class A Public Water Supplies*, and may include surface waters found in National Parks, State Forests and Parks, Areas of Critical Environmental Concern (ACEC) and those protected by special legislation (MA DEM 1993). Wetlands that border ORWs are designated as ORWs to the boundary of the defined area.

- Four areas in the Housatonic River Basin have been formally designated as ACECs by the Massachusetts Secretary of Environmental Affairs due to their unique environmental characteristics, including the ability to support rare or endangered species (MA DEM 1993). These ACECs are: Hinsdale Flats Watershed, which includes 14,500 acres in the headwaters of the East Branch Housatonic River (above the Old Grist Mill Dam in the town of Hinsdale); Karner Brook Watershed, which includes 7,000 acres within Egremont and Mount Washington (encompassing the entire length of Karner Brook); Schenob Brook Drainage Basin, which includes 13,750 acres in the Southern Berkshire Mountains near the Massachusetts-Connecticut border; and Kampoosa Bog Drainage Basin, which includes 1,350 acres in Stockbridge and Lee.

Class B Cold Water Fisheries in the Housatonic River Basin:

- East Branch Housatonic River, from its source to the Crane Paper Company, Dalton
- West Branch Housatonic River, entire length
- Southwest Branch Housatonic River, entire length
- Goose Pond Brook, entire length
- Williams River, entire length
- Green River, entire length
- Hubbard Brook, entire length
- Fenton Brook, entire length

Class B Warm Water Fisheries in the Housatonic River Basin:

- East Branch Housatonic River, from Crane Paper Company, Dalton, to the confluence with the Housatonic River
- Housatonic River, Pittsfield, entire length (confluence of Southwest and West Branch Housatonic Rivers to the Massachusetts/Connecticut State Line)

Unlisted waters not otherwise designated in the SWQS are designated *Class B, High Quality Water*. According to the SWQS, where fisheries designations are necessary, they shall be made on a case-by-case basis.

SUMMARY OF EXISTING CONDITIONS AND PERCEIVED PROBLEMS

The Clean Water Act section 303(d) requires states to identify those waterbodies that are not meeting Surface Water Quality Standards (SWQS). The following waterbodies in the Housatonic River Basin are on the 1998 Massachusetts Section 303(d) list of waters (MA DEP 1999a):

1998 303(d) Listed Waterbody	Cause of Impairment
East Branch Housatonic River	priority organics (PCB) and pathogens (fecal coliform bacteria)
Housatonic River	PCB and pathogens
West Branch Housatonic River	pathogens
Hubbard Brook	pathogens
Goose Pond Brook	pathogens
Konkapot River	pathogens and suspended solids
Windsor Brook	flow alteration
Long Pond Brook*	flow alteration
Center Pond	PCB
Woods Pond	PCB
Prospect Lake	noxious aquatic plants
Ashmere Lake*	noxious aquatic plants
Lake Buel*	nutrients

*needs confirmation (additional data collection is necessary to confirm the presence of impairment)

PCB contamination in the Housatonic River Basin is widespread, affecting the East Branch Housatonic River and the mainstem Housatonic River as well as other areas in the watershed. In 1981, DEP Bureau of Waste Site Cleanup (BWSC) issued an Administrative Consent Order designating the GE Company Pittsfield and the river as a hazardous waste site because of severe PCB contamination (Steenstrup 1999). Under the Massachusetts Contingency Plan (MCP), DEP established the following GE sites as priority disposal sites under M.G.L. c. 21E on the following dates (MA DEP 1995):

East Street Area II on February 24, 1986
East Street Area I on November 6, 1987
Housatonic River on January 9, 1988
Unkamet Brook on April 7, 1988
Newell Street Area I on December 6, 1988
Hill 78 Landfill Area on January 11, 1990

GE/Facility (Remainder/General) on February 5, 1990
Lyman Street Parking Lot on December 20, 1990
Allendale School Yard on November 20, 1991
Newell Street Area II on August 4, 1993
Former Oxbows A, B, C, E, F, J and K on January 28, 1994

Highly contaminated sediment and riverbank soils in the vicinity of Building 68, located at the GE facility were removed in 1998 (Steenstrup 1999). Additional contaminated sediments and riverbank soils in the stretch from Newell Street down to the Lyman Street Bridge (known as the "1/2 mile stretch") were scheduled for removal commencing in late summer/early fall 1999 and expected to be completed by June 2001. However, in 1999, additional dense non-aqueous phase liquids (DNAPL) were found at sites along the river in the "1/2 mile stretch". Prior to initiating the cleanup effort additional source control measures in the form of sheetpiling, and the installation of additional recovery wells were implemented to ensure that sources of contamination to the river (both Light NAPL and DNAPL) would be contained. Source control activities were undertaken in the East Street Area II, Newell Street Parking Lot and the Lyman Street Parking Lot sites. These measures were required to prevent recontamination of the river by sources adjacent to the river after the excavation and capping effort in the river is completed (Steenstrup 1999). Due to the segmented nature of the cleanup activities, the magnitude of PCB contamination in the river is ever changing.

In April 1982 the state issued a fish consumption advisory for the Housatonic River. The advisory recommended that the general public should not consume fish, frogs and turtles from the Housatonic River between Dalton and Sheffield because of PCB contamination. DPH updated this advisory in 1995 to include a recommendation that fish taken from feeder streams to the Housatonic River should be trimmed of fatty tissue prior to cooking (MA DPH 1999). In 1994, DPH issued a statewide *Interim Freshwater Fish Consumption Advisory* for mercury (MA DPH 1994). This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. The advisory encompasses all freshwaters in Massachusetts therefore the *Fish Consumption Use* can not be assessed as support.

SOURCES OF INFORMATION

Multiple local, state and federal agencies provided information used in the water quality assessment of the Housatonic River Basin. Within the Department of Environmental Protection (DEP) information was obtained from three programmatic bureaus: Bureau of Resource Protection (BRP, see below), Bureau of Waste Prevention (industrial wastewater discharge information) and the Bureau of Waste Site Cleanup (hazardous waste site cleanup information). Specifically, water quality, habitat assessment, and biological data were provided by DEP BRP Division of Watershed Management (DWM) Watershed Planning Program. Water withdrawal and wastewater discharge permit information was provided by the DWM Watershed Permitting Program (Water Management Act, and National Pollutant Discharge Elimination System). [Note: The BRP DWM Drinking Water Program evaluates the status of the *Drinking Water Use* and this information is therefore not provided in this assessment report.]

Other state agencies contributing information to this report include: the Massachusetts Department of Public Health (MA DPH), the Department of Fisheries, Wildlife, and Environmental Law Enforcement (DFWELE) Division of Fisheries and Wildlife and Riverways programs, and the Department of Environmental Management (DEM). Federal agencies contributing include the EPA and United States Geological Survey (USGS).

The USGS as part of their National Water-Quality Assessment (NAWQA) Program in the Connecticut, Housatonic, and Thames River Basins Study Unit conducted water quality sampling in the Housatonic River Basin between 1992 and 1995. A summary of their data collection by study component is provided in Table 4. Results of the USGS investigations are published in Breault and Harris (1997), Coles (1996 and 1998), Garabedian *et al.* (1998), and Harris (1997). This USGS data was identified as meeting the quality objectives and therefore was utilized in the assessment process.

Table 4. Summary of Data Collection by USGS NAWQA Program in the Housatonic River Basin (Garabedian *et al.* 1998).

STUDY COMPONENT	STUDY OBJECTIVE	BRIEF DESCRIPTION OF SAMPLING EFFORT	FREQUENCY OF SAMPLE COLLECTION AND LOCATION*
Bottom-sediment survey	Determine presence of potentially toxic compounds within the bed sediments of streams	Sample depositional zones of streams for trace elements and hydrophobic organic compounds	Once per site (1994) EB, WP, HR, GR, KR
Water chemistry, synoptic sites	Describe the short-term presence and distribution of contamination over broad areas	Sample streams during high and low flow conditions for pesticides and (or) nutrients, organic carbon, suspended sediment, and streamflow	Once per site (1994-1995) KR
Contaminants in fish tissues	Determine the presence of contaminants that can accumulate in fish tissues	Collect eight white sucker and submit composite of whole fishes for organic compound analysis.	Once per site (1994) EB, WP, GR, KR

*East Branch Housatonic River at Pittsfield (EB), Housatonic River at Woods Pond in Lenox (WP), Housatonic River at Great Barrington (HR), Green River at Great Barrington (GR) and Konkapot River at Ashley Falls (KR).

The USGS also conducted a suspended sediment study in the lower Housatonic River Basin between April 1994 and March 1996 to characterize suspended sediment concentrations, discharges, loads and yields during storm events and stable streamflow conditions. Continuous record data at three stations, two sites on the Housatonic mainstem: at Great Barrington and upstream of the confluence with the Konkapot River "Ashley Falls" in Sheffield and one station on the Green River) were collected. Partial-record data was also collected on the following tributaries: Williams River, Hubbard Brook, Ironworks Brook, and the Konkapot River. At these locations, most suspended sediment concentration sampling occurred during the rising and falling stream stages of runoff events (biasing the dataset towards wet weather conditions) while periodic sampling was conducted to capture the entire streamflow range during stable stream conditions. These instantaneous data are reported in Socolow *et al.* (1996) and Socolow *et al.* (1997). Daily mean concentrations of suspended sediment were calculated from the instantaneous dataset and the ranges are reported in the appropriate segment summaries later in this report. Suspended sediment concentrations (reported in mg/L) by USGS are synonymous with suspended solids concentrations (also mg/L) reported by DEP DWM. Data from the three continuous record stations were analyzed to determine the percentage of the time (over the study period) where the instream concentration of suspended solids exceeded 25 mg/L (Use Assessment Methodology Table 3).

In addition to state and federal agencies, regional, local and citizen monitoring groups provided valuable data/information for the watershed management process which may be used to indicate areas of degraded water quality, as well as causes and sources of contamination. The Berkshire Regional Planning Commission (BRPC) conducted an "Assessment of Land Use Activities and Nonpoint Source Pollution in the Housatonic River Watershed" under a 604(b) grant (Project # 96-05/604) (Berkshire Regional Planning Commission 1999). BRPC's assessment was conducted between August 1997 and June 1999 and identifies and inventories the existing and potential sources of nonpoint source pollution in the Housatonic River Watershed. The Housatonic Valley Association (HVA), in conjunction with Stream Teams (in subwatersheds of the Housatonic River Basin), provided useful information from windshield and shoreline surveys for the assessment process (Housatonic Valley Association 1999 and Regan 2000) .

A decision was made by DEP DWM to focus the 1997 sampling efforts on the Konkapot River because it was listed on the 1996 303(d) list of waters because of pathogens and suspended solids (MA DEP 1997a). Inclusion of the Konkapot River on the 303(d) list had been based on a very limited dataset (one station). Stations sampled in 1997 were selected to better characterize the river (bracketing changes in land-use) in an attempt to determine sources of pollution. Fish toxics monitoring was also conducted in this river (above and below the dam at Ashley Falls) to determine if fishes from unobstructed reaches of the Housatonic River tributaries have elevated body burdens of PCBs compared to those isolated from the mainstem by barriers to migration.

Site specific evaluations of other water quality issues in the Housatonic River Basin related to either wastewater discharges and/or water withdrawals were conducted by DEP DWM either through field investigations (where resources could be allocated) or through the review of discharge monitoring reports (DMRs) and annual water withdrawal reports submitted by the permittees.

Water Management Act (WMA): Registration and permit files (both public water suppliers and other industrial users) were reviewed to determine where stream segments might be affected by water withdrawal activities (LeVangie 2000, MA DEP 2000c, and Prendergast 1999 and 2000). The information is summarized in the segments where the withdrawals occur. However the following WMA registrants do not withdraw water from streams discussed in this report. These include:

- V1021520 Cranwell Conference Center, Inc. surface withdrawal (0.02 MGD) from Cranwell Pond
- 10211304 Butternut Basin Ski Area registered withdrawal of 0.43 MGD from three sources (two surface and one well) from a small unnamed tributary to the Housatonic River in Great Barrington. Actual water withdrawal figures have not been received.
- The Pittsfield Water Department is registered (10223601) to withdraw 13.5 MGD of water from six reservoirs (Ashley Lake, Lower Ashley Intake, Sandwash, Farnham, Sackett, and Cleveland). In 1998, their total average water use was 10.67 MGD (LeVangie 2000). Cleveland, Pittsfield Water Department's primary source, is discussed in the Cleveland Brook segment of this report (MA21-08). The Ashley Reservoir System is located in the town of Washington near the southeastern corner of Pittsfield (Prendergast 2000). All of the above named reservoirs excluding Cleveland are treated at the Ashley Water Treatment Facility. The Ashley Water Supply System is comprised as follows: Ashley Lake has a storage capacity of 409 MG and flows via Ashley Brook directly to the 4 MG Lower Ashley Reservoir. The Sandwash Reservoir in the Mill Brook subwatershed has a storage capacity of 245 MG and flows through an open channel to the 445 MG Farnham Reservoir. From the Farnham Reservoir, water flows through a 30" transmission main to a hydroelectric generation facility to the lower Ashley Reservoir intake structure and directly to the Ashley Treatment Facility. The 155 MG Upper Sackett Reservoir located on the Hinsdale/Dalton/Washington town line flows via a 10" transmission main to the Lower Ashley Reservoir intake structure and directly to the Ashley Filtration Facility. The Sackett System is currently using approximately 0.19 MG from the Upper Sackett Reservoir. The Ashley Treatment Facility has two water treatment units with a total capacity of 6.25 MGD. Overflow from the Lower Ashley Reservoir flows to Sackett Brook which flows west to the Housatonic Main Stem approximately one mile north of the Pittsfield WWTP. A brief summary of the 1998 annual reports submitted by the Pittsfield Water Department for the Ashley Reservoir System are as follows (LeVangie 2000):

Source ID#	Reservoir	Safe Yield	1998 Average Use
1236000-01S	Ashley Lake and Lower Ashley Reservoir	0.8 MGD	0.22 MGD
1236000-02S	Farnam Reservoir	1.8 MGD	2.27 MGD
1236000-04S	Upper Sackett Reservoir	0.8 MGD	0.28 MGD
1236000-05S	Sandwash Reservoir	1.3 MGD	thru Farnam
	Total	4.7 MGD	2.77 MGD

NPDES Discharge Monitoring Reports (DMRs): Four of the six municipal wastewater treatment plants, Pittsfield Sewer Commission (MA0101681), Lee WWTP (MA0100153), Great Barrington WWTP (MA0101524) and the West Stockbridge WWTP (MA01013110), submit quarterly toxicity testing reports to EPA and DEP as required by their NPDES permits. Five industrial NPDES dischargers, Crane & Co., Inc (MA0000671), GE Pittsfield (MA0003891), Schweitzer-Mauduit International (MA0005371), and the Mead Corporation Laurel Mill (MA0001716) and Willow Mill (MA0001848), also conduct quarterly toxicity testing of their effluents. Data from these toxicity reports is maintained by DWM in a database known as "Toxicity Testing Data - TOXTD" (Dallaire 2000). Information from the reports includes: survival of test organisms exposed to ambient river water (used as dilution water), physicochemical analysis (e.g., hardness, alkalinity, pH, total suspended solids) of the dilution water, and the whole effluent toxicity test results. These data were reviewed and summarized (ranges) for use in the assessment of current water quality conditions in the Housatonic River Basin.

Note: The following minor NPDES facilities were listed as discharging in the Housatonic River Basin (MA DEP 2000b and 2000c) . Some discharge into streams not assessed in this report. These facilities include:

- MA0032191 Brook Hill Estates, Dalton.
- MA0035491 Eisner Camp Institute, Great Barrington. Current status: connected to sewer.
- MA0034461 Carpenter's Variety, Great Barrington.
- MA0103250 Root Reservoir Water Treatment Facility, Lenox, discharges into Lenox Mountain Brook.
- MA0035335 Getty Station, Pittsfield.
- MA0032158 Pittsfield Sand and Gravel, Pittsfield.
- MA0027294 Sheffield Plastics, Inc., Sheffield. Current status: NPDES permit terminated in May 1999. The facility's stormwater discharges are now covered under the multi-sector general permits MAR05B410 and MAR05B411. The stormwater discharges into Schenob Brook via a ditch and a wetland, respectively (Vergara 1999).
- MA0034231 South Egremont Mobil, South Egremont.

OBJECTIVES

This report summarizes information generated in the Housatonic River Basin through *Year 1* (information gathering in 1996) and *Year 2* (environmental monitoring in 1997) activities established in the "Five-Year Cycle" of the Watershed Initiative. Data collected by DWM in 1997/1998, in accordance with the preliminary Quality Assurance Project Plan (QAPP) (MA DEP 1998b), are provided in Appendices A, B, C and D (QA/QC, data tables, and two technical memorandum; Housatonic River Watershed 1997 Biological Assessment and 1997 Housatonic Survey: Macroinvertebrate RBP II Evaluations Upstream and Downstream of NPDES Discharges, respectively). Together with other sources of information (identified in each segment assessment), the status of water quality conditions of lakes and streams in the Housatonic River Basin was assessed in accordance with EPA's and DEP's use assessment methods. Not all waters in the Housatonic River Basin are included in the DEP/EPA Water Body System (WBS) database or this report (Dallaire 1999).

The objectives of this water quality assessment report are to:

1. Evaluate whether or not surface waters in the Housatonic River Basin, defined as segments in the WBS database, currently support their designated uses (i.e., meet water quality standards),
2. identify water withdrawals and/or major point (wastewater discharges) and nonpoint (land-use practices, stormwater discharges, etc.) sources of pollution that may impair water quality conditions,
3. identify the presence or absence of any non-native macrophytes in lakes,
4. identify waters (or segments) of concern that require additional data to fully assess water quality conditions, and
5. recommend additional monitoring needs and/or remediation actions in order to better determine the level of impairment or to improve/restore water quality.

SEGMENT REPORT FORMAT

The segment order in this assessment report follows the Massachusetts Stream Classification Program (Halliwell *et al.* 1982) hierarchy. Stream segments are organized hydrologically (from most upstream to downstream). Tributary summaries follow the segment into which they discharge. The Housatonic River Basin lake (the term "lake" will hereafter be used to include lakes, pond, and impoundments) summary is presented after the stream segments. Each stream segment summary is formatted as follows:

SEGMENT IDENTIFICATION

name, water body identification number (WBID) (Dallaire 1999), location, length/size, classification.

Sources of information: coding system (waterbody identification number e.g., MA21-01) used by DEP to reference the stream segment in databases such as 305(b) and 303(d), the Massachusetts SWQS (MA DEP 1996), and other descriptive information.

SEGMENT DESCRIPTION

flow direction, tributary confluences, and major land-use estimates (the top three uses for the subwatershed and 100' riparian zone)

Sources of information: descriptive information from USGS topographical maps, base geographic data from MassGIS, land use statistics from a GIS analysis using the MassGIS land use coverage developed at a scale of 1:25,000 and based on aerial photographs taken in 1985 and 1990-1992 (EOEA 1999b and EOEA 1999c).

SEGMENT LOCATOR MAP

Subbasin map, major river location, segment origin and termination points, and segment drainage area (gray shaded)

Sources of information: MassGIS (EOEA 1999b) data layers (stream/lake segments, and quadrangle maps).

WATER WITHDRAWALS AND WASTEWATER DISCHARGE PERMIT INFORMATION

WMA, NPDES, and stormwater permits

Sources of information: WMA Database Printout (LeVangie 2000); open permit files located in Worcester and Springfield DEP Offices (MA DEP 2000b and 2000c); MassGIS Priority Resource Map (EOEA 1999a); Department Environmental Management (DEM) Housatonic River Basin report (MA DEM 1999); and the Assessment of Land Use Activities and Nonpoint Source Pollution in the Housatonic River Watershed Report (Berkshire Regional Planning Commission 1999).

USE ASSESSMENT

Discussion of current reliable data/information

Sources of information: recent DWM survey data (Appendix B, C, D) and synoptic lake survey data (MA DEP 1997b) as well as the following: data from the DEP DWM Toxicity Testing Database "TOXTD" (Dallaire 2000), USGS streamflow data (Socolow *et al.* 1998, and Socolow *et al.* 1999), USGS NAWQA Program (Garabedian *et al.* 1998), and data from the GE Pittsfield Company Waste Site Cleanup Investigations (Steenstrup 1999 and Stefanosky 1999). Any relevant historical data (> 5 years old) may also be described. The MA DPH Freshwater Fish Consumption Advisory List (MA DPH 1999) was used to determine the *Fish Consumption Use*.

SUMMARY

Use summary table (uses, status).

RECOMMENDATIONS

Additional monitoring and implementation needs.

HOUSATONIC RIVER BASIN – RIVER SEGMENT ASSESSMENTS

The following segments in the Housatonic River Basin are included in this report:

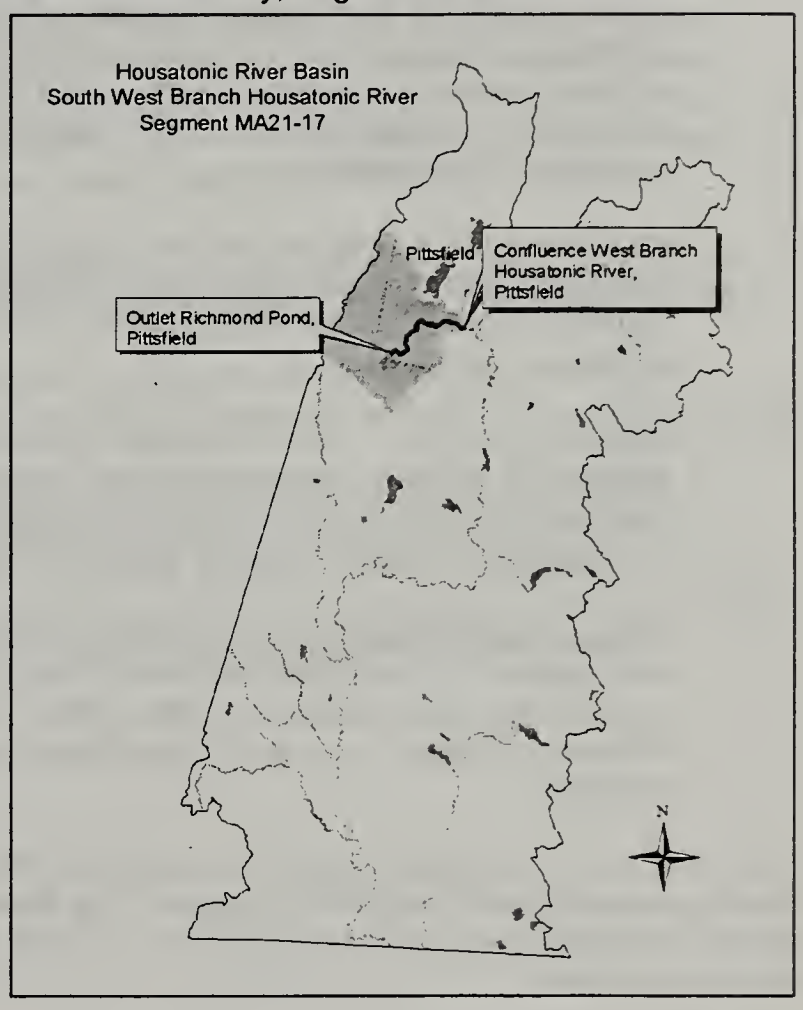
Figure 4. Housatonic River Basin – Lakes

SOUTHWEST BRANCH HOUSATONIC RIVER (SEGMENT MA21-17)

Location: Outlet of Richmond Pond, Pittsfield to confluence with West Branch Housatonic River, Pittsfield.
Segment Length: 5.8 miles. Classification: Class B, Cold Water Fishery.

SEGMENT DESCRIPTION

The Southwest Branch Housatonic River, a Class B Cold Water Fishery, originates at the outlet of Richmond Pond in Pittsfield. The river lies between the Taconic Range to the northwest and Lenox Mountain on the southeast. Three streams, Shaker, Jacoby and Smith Brooks, whose headwaters lie in the Pittsfield State Forest, flow southeast into the Southwest Branch Housatonic River. In the southeastern portion of the river's watershed, land-use includes the Pittsfield Municipal Airport, the Bousquet Ski Area, and the newly developed Stearns Industrial Park. Two unnamed tributaries to the Southwest Branch Housatonic River drain around the airport. Maloy Brook is the last stream that flows into the Southwest Branch Housatonic River prior to its confluence with the West Branch Housatonic River south of Pittsfield Center.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	63%
Agriculture	12%
Open Land	8%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	53%
Residential	27%
Open Land	6%

WITHDRAWALS AND DISCHARGES

NPDES:

1. MA0028410 - Lakeside Christian Camp has connected to the Pittsfield City Sewer System. EPA closed the permit file (Vergara 1999).

Stormwater:
Several operators at the Pittsfield Municipal Airport applied for the general stormwater permits (Berkshire Regional Planning Commission 1999, unless otherwise noted):

1. MAR00B310 ALNASCO,
2. MAR00B331 Lyon Aviation, Inc.,
3. MAR00B312 BETNR Industrial Development,
4. MAR00B313 H. G. Maxymillian, Inc., and
5. MAR00B316 The City of Pittsfield (MA DEP 2000b).

USE ASSESSMENT

Benthic macroinvertebrate sampling was conducted by DWM biologists in August 1997 in the Southwest Branch Housatonic River (station HW02S) downstream from Barker Road in Pittsfield (approximately 0.5 miles upstream of the confluence with the West Branch Housatonic River) (Appendix B, Table B1). In April 2000, the Housatonic Valley Association (HVA) conducted a windshield survey of the Southwest

Branch Housatonic River. Sediment sampling in the Southwest Branch Housatonic River between Route 20 and Barker Road for total PCB has been conducted as part of the General Electric Pittsfield (GE) Housatonic River Project (Stefanosky 1999).

- Bioassessment/Habitat – The benthic macroinvertebrate community RBP III analysis resulted in a total metric score of 22 (as compared to 42 at the regional reference site KR11) indicating slight/moderate impairment (Appendix C). Habitat quality limitations (severe embeddedness of cobble substrates and nonpoint source pollution in the form of trash and debris) more than water quality was thought to be most limiting to biological integrity. Sand and other fine sediment loads – both organic and inorganic forms – were considered to be the greatest threat to the benthic community, however inorganic nutrient loadings, as reflected in the luxuriant algal community, also need to be considered.

  No obvious sources of streambank erosion or riparian land-use that would result in siltation in the Southwest Branch Housatonic River was observed by HVA, although they did observe a fine layer of silt throughout the river (Regan 2000). According to HVA, instream deposition was very evident at Barker Road.

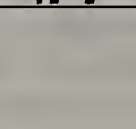
- Sediment Quality – Total PCB ranged between 0.00453 and 0.451 PPM dry weight in the 25 samples analyzed in sediment samples collected to a depth of ≤ 1 ft. (Roy F. Weston, Inc. 1999). Twenty eight percent of these samples were less than or equal to the L-EL of 0.07 PPM. None of the samples exceeded the S-EL of 5.3 PPM assuming a TOC of 1%.

- Fishery Management Policy – According to Western Wildlife District of the DFWELE, the current management policy for the Southwest Branch Housatonic River consists of spring stocking of brook, brown and rainbow trout (Bell 1999). A qualitative assessment of fishing pressure indicates significant use as an urban fishery between Richmond Pond and Barker Road in Pittsfield.

The *Aquatic Life Use* is assessed as non-support based on the above information coupled with the habitat quality observations of the DWM biologists. The *Aesthetics Use* is assessed as support upstream of Barker Road and non-support downstream of Barker Road to the confluence with the West Branch Housatonic River.

- Fish Consumption Advisory – There is currently no specific fish consumption advisory for this river. The DPH fish consumption advisory in effect for the mainstem Housatonic River includes a provision that recommends that fish taken from feeder streams to the Housatonic River be trimmed of fatty tissue prior to cooking (MA DPH 1999). The intention of this provision is to minimize the potential risk associated with fish that may migrate in or out of the mainstem Housatonic River.

Designated Uses Status: Southwest Branch Housatonic River (Segment MA21-17)

Aquatic Life		NON-SUPPORT. The macroinvertebrate analysis indicated slight/moderate impairment, therefore the *Aquatic Life Use* is assessed as non-support. The lower 0.5 mile reach of this segment is also impaired by habitat quality limitations (severe sedimentation).
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT. The upper 5.3 miles of this segment is evaluated as supporting this use. NON-SUPPORT. The lower 0.5 mile reach of this segment does not support this use as evidenced by severe sedimentation, trasi. and debris.

RECOMMENDATIONS: SOUTHWEST BRANCH HOUSATONIC RIVER (SEGMENT MA21-17)

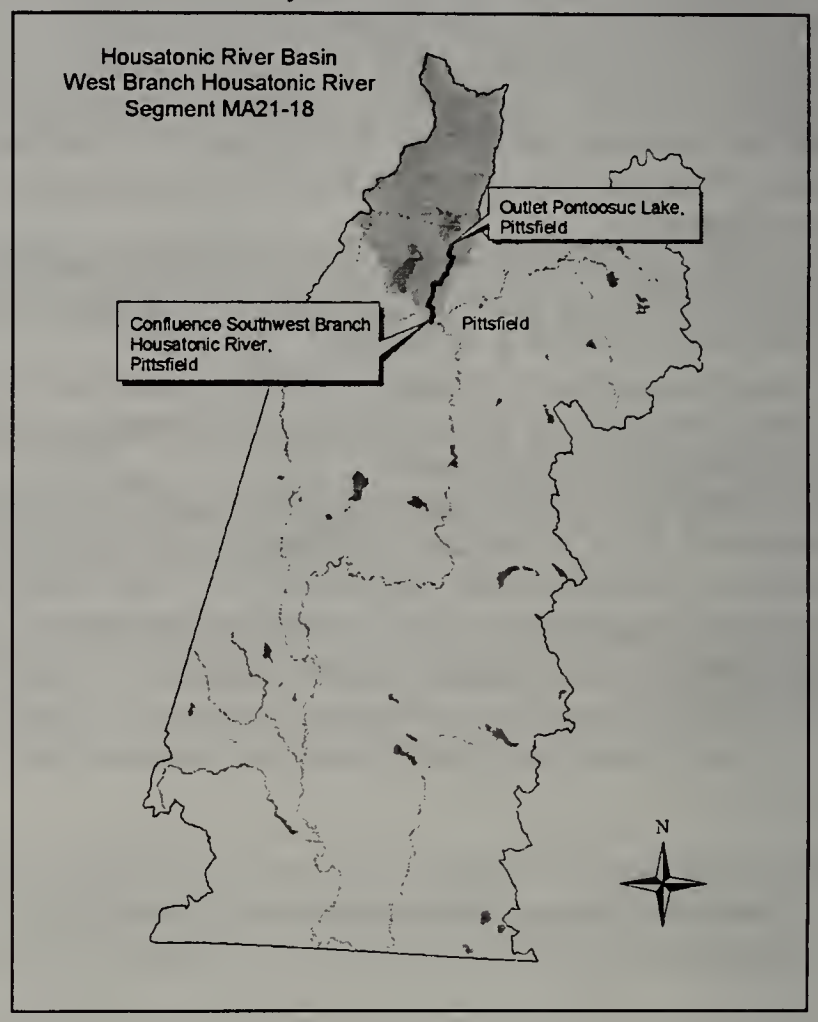
- Further investigate/isolate sources of both inorganic and organic sediment loads to the Southwest Branch Housatonic River; implement BMPs to reduce sedimentation.
- Conduct a stream cleanup effort to remove anthropogenic debris (trash, car parts, scrap metal, etc).
- Additional monitoring (nutrients, fecal coliform bacteria, and dissolved oxygen) is recommended to more completely evaluate the status of the recreational uses and locate sources of nutrient inputs.
- DPH recommends that fishes taken from tributaries to the Housatonic River should be trimmed of fatty tissue before cooking (MA DPH 1999). Since there is a lack of any instream barriers to fish migration between the Southwest Branch Housatonic River and the East Branch Housatonic River and the mainstem Housatonic River (where PCB contamination is extremely high), body burdens of PCB in the edible portion of fish from the Southwest Branch Housatonic River merits further investigation.
- The Bousquet Ski Area reports 98% snowmaking capacity. The ski area's water withdrawal location(s) (PWS # 1236010-01G) and volume should be documented in order to determine whether or not a WMA permit is necessary.
- None of the general stormwater permittees reapplied for the more recent multi-sector stormwater permit (noticed in the Federal Register in September 1998). Stormwater controls at the airport should be evaluated for effectiveness.
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and pages IV-45-46) should be reviewed to help design future monitoring plans for the Southwest Branch Housatonic River subwatershed.

WEST BRANCH HOUSATONIC RIVER (SEGMENT MA21-18)

Location: Outlet of Pontoosuc Lake, Pittsfield to confluence with Southwest Branch Housatonic River, Pittsfield. Segment Length: 4.1miles. Classification: Class B Cold Water Fishery.

SEGMENT DESCRIPTION

The West Branch Housatonic River, a Class B Cold Water Fishery, flows south from the outlet of Pontoosuc Lake in Pittsfield towards the center of Pittsfield. The river receives the flow from Onota Brook (draining Onota Lake) just upstream of Wahconah Park. The former King Street Landfill, owned by the City of Pittsfield, is located off of King Street on the west side of the West Branch Housatonic River. The 82-acre site, which is part of the 110 acre Wahconah Park property, had been a municipal dump since the 1930s. The dump was used primarily for large items and demolition debris. There were, however, reports of other wastes including trash and GE Company wastes. After flowing around the park the river turns west for a short distance before heading south to its confluence with the Southwest Branch Housatonic River in Pittsfield. The confluence of these two branches forms the mainstem Housatonic River. Prior to reaching the Southwest Branch, the West Branch Housatonic River flows adjacent to the Dorothy Amos Park. This park was sampled for PCB contamination in the field season of 1997. PCB removal action took place in 1998 and the final landscaping activities at the park were completed in early 1999.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	59%
Agriculture and Residential	12%
Open Land	8%

Land-use estimates in the 100' riparian zone from the streambanks:

Residential	44%
Wetlands	20%
Forest	13%

WITHDRAWALS AND DISCHARGES

Stormwater:

1. MAR00A975 - Clock Tower Condominium (Pittsfield Publications, Inc.) in Pittsfield applied for a general stormwater permit (Berkshire Regional Planning Commission 1999).
2. MAR00A974 - The Clock Tower Condominium Unit 1 (The Eagle Publishing Company) in Pittsfield has applied for a general stormwater permit (MA DEP 2000b).

USE ASSESSMENT

Benthic macroinvertebrate sampling was conducted by DWM biologists in August 1997 in the West Branch Housatonic River (station HW01) downstream from Route 20 in Pittsfield (Appendix B, Table B1). The Housatonic River West Branch Stream Team conducted shoreline surveys of the West Branch Housatonic River in the fall of 1998 (Housatonic Valley Association 1999). Preliminary sampling for total PCB in the sediment of the West Branch Housatonic River was conducted by EPA in the vicinity of the King Street Landfill in 1999.

- Bioassessment/Habitat – The benthic macroinvertebrate RPB III analysis resulted in a total metric score of 22 (as compared to 42 at the regional reference site KR11) indicating slight/moderate impairment (Appendix C). Both instream and riparian habitat conditions were extremely degraded throughout the sampling reach. Factors contributing to the habitat degradation included substantial deposits of sand and other fine sediments, various forms of trash and debris, erosion, and dense algal cover. Moderate turbidity was also visually observed. The benthic macroinvertebrate analysis suggests that organic enrichment may contribute to the impairment of the aquatic community.

  The West Branch Stream Team also identified trash and debris as being prevalent throughout the entire segment (Housatonic Valley Association 1999). Sewage odors were also noted in their shoreline survey results near Wahconah Park and near Mill Street bridge.

- Sediment Quality – Total PCB ranged between 0.306 and 76.8 PPM dry weight in the 14 samples analyzed in sediment samples collected to a depth of $\leq$ 1ft. (Stefanosky 1999). None of the samples were less than or equal to the L-EL of 0.07 PPM. Twenty nine percent of the samples exceeded the S-EL of 5.3 PPM and 14% of the samples exceeded the S-EL of 53 PPM. One sediment sample was also collected in the impoundment of the West Branch Housatonic River near Wahconah Street (upstream of the former King Street Landfill). This sediment sample contained 0.56 PPM dry weight of total PCB.

- Fishery Management Policy - According to the Western Wildlife District of the DFWELE, there is no management policy for the West Branch Housatonic River (Bell 1999). Pontoosuc Lake, however, is actively managed for both coldwater (brown/rainbow trout) and coolwater (tiger muskie/northern pike) fisheries. Improper installation of the fish screen at Pontoosuc Lake Dam results in the escape of these and other fishes into the river system.

- Fish Consumption Advisory – There is currently no specific fish consumption advisory for this river. The DPH fish consumption advisory in effect for the mainstem Housatonic River includes a provision that recommends that fish taken from feeder streams to the Housatonic River be trimmed of fatty tissue prior to cooking (MA DPH 1999). The intention of this provision is to minimize the potential risk associated with fish that may migrate in or out of the mainstem Housatonic River.

Designated Uses		Status: West Branch Housatonic River (Segment MA21-18)
Aquatic Life		NON-SUPPORT. The entire 4.1 mile length of this segment is evaluated as not supporting this use due to habitat quality impairment and enrichment, and sediment contamination.
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NON-SUPPORT. The entire 4.1 mile length of this segment is evaluated as not supporting this use as evidenced by severe sedimentation, trash and debris, moderate turbidity, and dense algal mats.

RECOMMENDATIONS: WEST BRANCH HOUSATONIC RIVER (SEGMENT MA21-18)

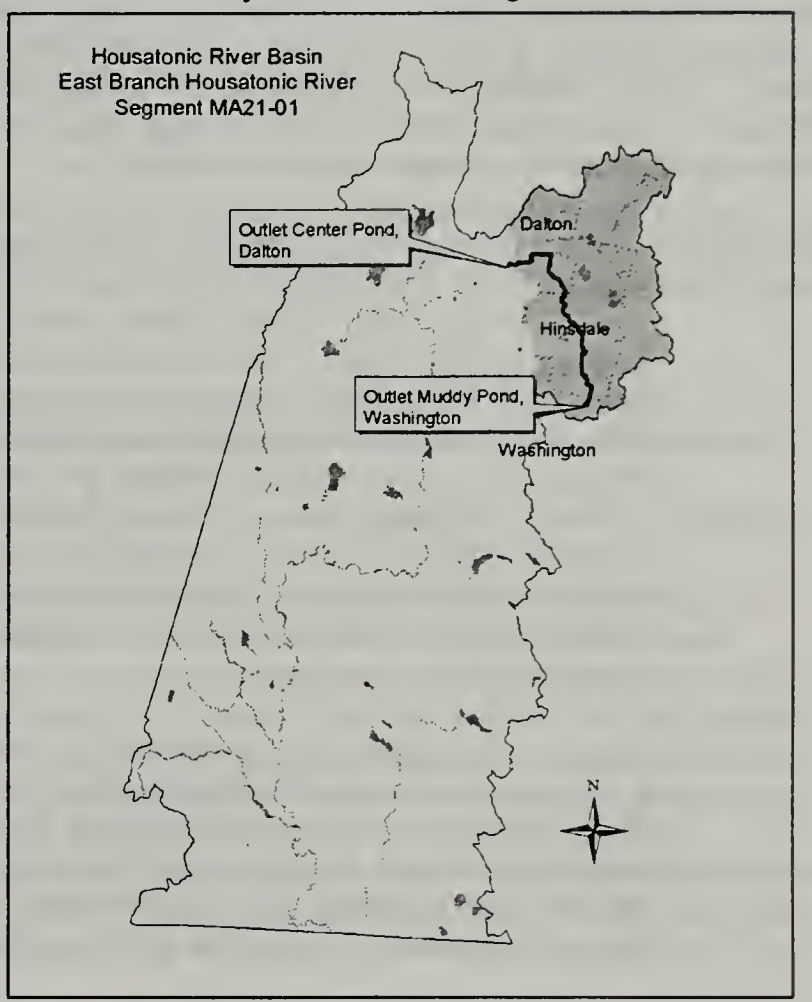
- Isolate sources of sediment loads to the West Branch Housatonic River, and implement BMPs to reduce sedimentation.
- Stream cleanups to remove trash and debris to improve aesthetics.
- Additional monitoring (nutrients, fecal coliform bacteria, and dissolved oxygen) is recommended to more completely evaluate the status of the recreational uses and locate sources of nutrient inputs.
- Body burdens of PCB in the edible portion of fish should be further investigated considering the close proximity to the GE Pittsfield sites and lack of any barriers to migration and including the vicinity of the former King Street Landfill.
- Continue to monitor the status of the former King Street Landfill cleanup effort. The landfill is a contaminated site and the City of Pittsfield and GE have been requested by DEP to investigate it.
- Monitor for PCB in the sediments of the West Branch Housatonic River in the vicinity (upstream and downstream) of the former King Street Landfill.
- The West Branch Stream Team identified the dam behind the Eagle Building off of Mill Street, Pittsfield as being a potential safety hazard. Determine if dam removal or renovation plans are underway.
- Address fish screen problems (retrofit outlet structure) at Pontoosuc Lake Dam to prevent/control downstream migration of sport fishes.
- Continue to implement recommendations set forth in the 1998/1999 Pontoosuc Lake Diagnostic Feasibility Study (ENSR 1999). Implementation of selected recommendations is underway as part of the Pontoosuc Lake Restoration Project No. 99-03/319 (MA DEP 2000a).
- Continue to implement recommendations set forth in the Diagnostic/Feasibility Study for Onota Lake, Pittsfield, Massachusetts (International Technology Corporation 1991). Implementation of selected recommendations is underway as part of the Onota Lake D/F Implementation Project No. 00-01/319 (MA DEP 2000a).
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and pages IV-44-45) should be reviewed to help design future monitoring plans for the West Branch Housatonic River subwatershed.

EAST BRANCH HOUSATONIC RIVER (SEGMENT MA21-01)

Location: Outlet of Muddy Pond, Washington to the outlet of Center Pond, Dalton.
Segment Length: 9.0 miles. Classification: Class B, Cold Water Fishery.

SEGMENT DESCRIPTION

The East Branch Housatonic River originates at the outlet of Muddy Pond in Washington. This Class B, Cold Water Fishery flows in a northerly direction receiving the flow from Bennett Brook. This brook flows from the outlet of Ashmere Lake to its confluence with the East Branch Housatonic in Hinsdale. The confluence of Bennett Brook and the East Branch Housatonic, and a major beaver dam have created the significant wetland in Hinsdale Flats, Dalton. The River then flows into the Hinsdale Flats State Wildlife Refuge (part of the Hinsdale Flats Watershed ACEC). As it nears Hinsdale Center, the East Branch Housatonic River receives the flow from Frisell Brook (draining the Plunkett Reservoir subwatershed). As it winds its way north at a very high velocity, the East Branch Housatonic River flows in close proximity to Route 8, toward the town of Dalton. In Dalton, the river slows, receives the flow from Cleveland Brook, and turns west as it nears the inlet to Center Pond. Center Pond was formed by the construction of a dam built by the Byron Weston Company (a subsidiary of the Crane & Co., Inc. today).



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	80%
Agriculture	6%
Residential	5%

Land-use estimates in the 100' riparian zone from the streambanks:

Wetlands	41%
Forest	32%
Residential	10%

WITHDRAWALS AND DISCHARGES

Stormwater:

1. MAR05A048 - Dufour Escorted Tours in Hinsdale applied for a general stormwater permit (Berkshire Regional Planning Commission 1999).

USE ASSESSMENT

Historically, this segment of the East Branch Housatonic River had received untreated wastewater as it flowed through the center of Hinsdale (DEQE 1981). According to the 1981 Housatonic River Water Quality Management Plan, the raw sewage discharge from Hinsdale was eliminated in June 1977 when Hinsdale was connected into the Dalton sewer system which then conveys sewage for treatment to the Pittsfield WWTP. The Town of Hinsdale is currently undergoing expansion of their sewer service area around both Ashmere Lake and Plunkett Reservoir (Berkshire Regional Planning Commission 1999). Additionally, there is a State Revolving Fund (SRF) Project listed for Hinsdale, the Ashmere Lake Collector Sewers. When construction is completed this should result in improved conditions along this segment. Without any recent fecal coliform bacteria data, however, this segment was not assessed for either the *Primary* or *Secondary Contact Recreational Use*.

GE Pittsfield collects water from this segment of the East Branch Housatonic River at the bridge on Old Dalton Road just off Route 8 in Hinsdale which they use as dilution water for their effluent toxicity tests.

- Ambient toxicity testing - Survival of the cladaceron, *Daphnia pulex*, exposed to East Branch Housatonic River water (48-hour) has been 100% in the 30 tests conducted between January 1991 and December 1998 (Dallaire 2000). Dilution water physical/chemical data from this segment of the river were as follows: pH ranged from 6.3 to 8.2 SU, alkalinity between 30 and 128 mg/L, hardness between 40 and 140 mg/L. There were no detectable concentrations of ammonia-nitrogen in any of the samples analyzed (all measurements <0.1 mg/L), and there were low concentrations of total suspended solids (<1.0 to 18 mg/L). Only one chloride measurement exceeded 15 mg/L. Conductivity ranged from 80 to 300 μmho/cm with one exception (450 μ mho/cm).

- Fishery Management Policy - According to the Western Wildlife District of the DFWELE, there is no management plan for the East Branch Housatonic River due to contamination issues (Bell 1999). However between Bullards Crossing Road in Hinsdale and the East Branch Housatonic River's confluence with Cleveland Brook, DFWELE's current management policy calls for multiple spring stockings of brook, brown and rainbow trout. The Western Wildlife District classified the stream as a stable, coldwater fishery.

- Tissue Chemistry - Fish tissue burdens of total PCB in yellow perch and trout collected upstream of Center Pond (station F1A) in 1980 and 1982 did not exceed 0.31 mg/kg wet weight (Stewart Laboratories, Inc. 1982).

Based on these data the *Aquatic Life Use* is assessed as support. The *Aesthetics Use* is also evaluated as support based on field reconnaissance, land-use data and low concentrations of total suspended solids.

- Fish Consumption Advisory – The state issued a fish consumption advisory for the Housatonic River in 1982. The advisory recommended that the general public should not consume fish, frogs and turtles from the Housatonic River between Dalton and Sheffield because of PCB contamination. In 1995, DPH updated their advisory to include a recommendation that fish taken from feeder streams to the Housatonic River should be trimmed of fatty tissue prior to cooking (MA DPH 1999). Because of this advisory, the *Fish Consumption Use* is not supported in the East Branch Housatonic River from the Dalton/Hinsdale town line and the outlet of Center Pond in Dalton. Upstream of the Dalton/Hinsdale line, the *Fish Consumption Use* is not assessed.

Designated Use		Status: East Branch Housatonic River (Segment MA21-01)
Aquatic Life		SUPPORT. The entire 9.0 mile length of this segment is evaluated as supporting this use.
Fish Consumption		NOT ASSESSED. The upper 7.5 miles of this segment is not assessed for this use. NOT SUPPORT. The lower 1.5 miles of this segment do not support this use because of the DPH advisory to eat no fish, frogs and turtles due to PCB contamination from Dalton to Sheffield.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		SUPPORT. The entire 9.0 mile length of this segment is evaluated as supporting this use.

RECOMMENDATIONS: EAST BRANCH HOUSATONIC RIVER (SEGMENT MA21-01)

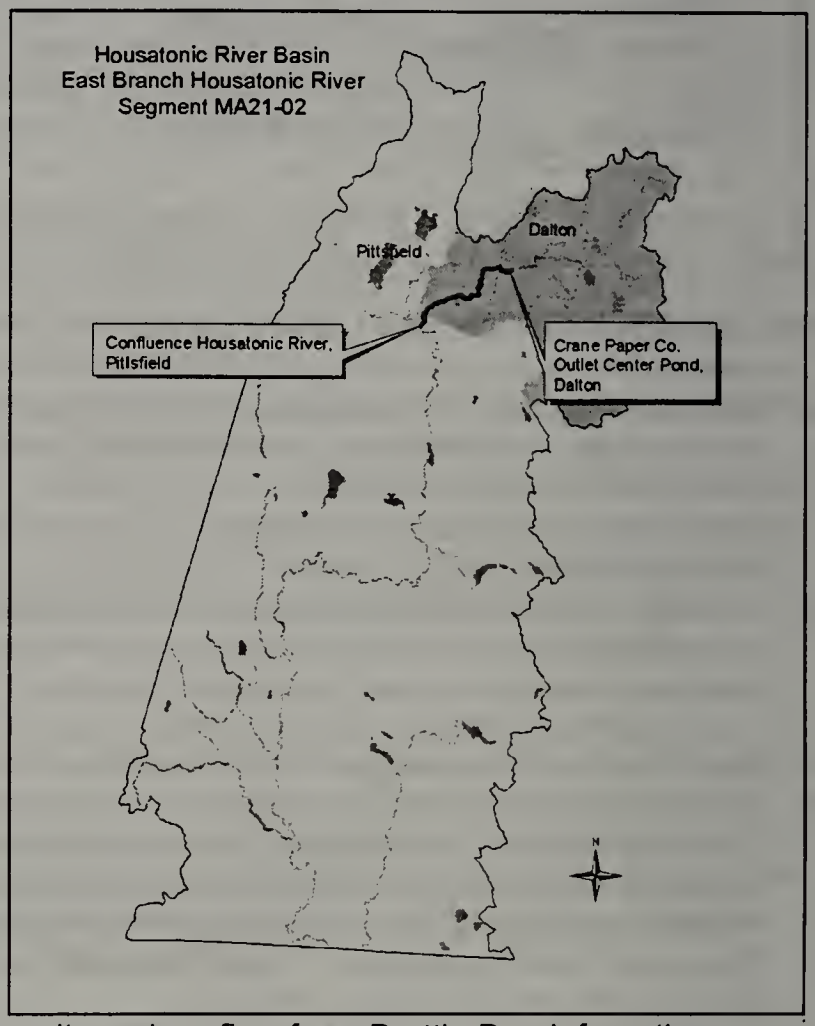
- Conduct fecal coliform bacteria sampling to assess the status of the *Primary* and *Secondary Contact Recreational* uses after the completion of the sewer service area expansion around both Ashmere Lake and Plunkett Reservoir.
- Protect the surface water resources. Consider development of a management plan for the Hinsdale Flats Watershed ACEC.
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and pages IV-41-43) should be reviewed to help design future monitoring plans for East Branch Housatonic River subwatershed.
- The DPH fish consumption advisory to eat no fish, frogs and turtles from the Housatonic River from Dalton to Sheffield because of PCB contamination results in the *Fish Consumption Use* being assessed as non-support. Whether or not the biota in the East Branch Housatonic River upstream of Center Pond in Dalton are contaminated by PCB is currently being investigated by EPA as part of their Ecological Risk Assessment. The DPH should review the results of this investigation and adjust the fish consumption advisory as needed.

EAST BRANCH HOUSATONIC RIVER (SEGMENT MA21-02)

Location: Outlet of Center Pond, Dalton to confluence with the Housatonic River, Pittsfield.
Segment Length: 7.9 miles. Classification: Class B, Warm Watery Fishery.

SEGMENT DESCRIPTION

This segment of the East Branch Housatonic River begins at the outlet of Center Pond in Dalton, and flows in a westerly direction where it is impounded by six dams associated with the mills of the Crane & Co., Inc. Paper Makers. The dams were once used by the company for the diversion of water for supply or power production. From upstream to downstream the dams can be identified as follows: Byron Weston Mill Dam #1, Byron Weston Mill Dam #2, Old Berkshire Mill Dam #3, Pioneer Mill Dam #4, Bay State Mill Dam #5 and the Government Mill Dam #6 (Noel 1999). The permitting for the possible breach of the Old Berkshire Mill Dam #3 has been initiated. An evaluation of the other dams between (not including) #1 and #6 is planned by the company and a phased approach for either their breach or repair will be done. The Crane & Co., Inc. treated process wastewater discharge to the East Branch Housatonic River is located in between the Bay State and Government Mill Dams. The river flows through these impoundments in Dalton, then crosses into the city of Pittsfield, and passes by the USGS gage at Coltsville. From there, the East Branch Housatonic River turns and meanders in a southerly direction, receiving the flow from Barton Brook from the east and Unkamet Brook from the northwest. The river then turns and meanders in a westerly direction, where it receives flow from Brattle Brook from the southeast, is bordered by the GE Pittsfield facility along its northern bank and runs adjacent to the Pittsfield landfill. The river then continues in a southwesterly direction through Pittsfield to its confluence with the mainstem Housatonic River.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	71%
Residential	10%
Agriculture	6%

Land-use estimates in the 100' riparian zone from the streambanks:

Wetlands	32%
Residential	17%
Industrial	15%

GE Company Pittsfield Waste Site Cleanup

In 1981, DEP Bureau of Waste Site Cleanup (BWSC) issued an Administrative Consent Order designating the GE Company Pittsfield and the river as a hazardous waste site because of severe PCB contamination (Steenstrup 1999). Under the Massachusetts Contingency Plan (MCP), DEP established the following GE sites as priority disposal sites under M.G.L. c. 21E on the following dates (MA DEP 1995):

East Street Area II on February 24, 1986
East Street Area I on November 6, 1987
Housatonic River on January 9, 1988
Unkamet Brook on April 7, 1988
Newell Street Area I on December 6, 1988
Hill 78 Landfill Area on January 11, 1990
GE/Facility (Remainder/General) on February 5, 1990
Lyman Street Parking Lot on December 20, 1990
Allendale School Yard on November 20, 1991
Newell Street Area II on August 4, 1993
Former Oxbows A, B, C, E, F, J and K on January 28, 1994

Highly contaminated sediment and riverbank soils in the vicinity of Building 68, located at the GE facility were removed in 1998 (Steenstrup 1999). Additional contaminated sediments and riverbank soils in the stretch from Newell Street down to the Lyman Street Bridge (known as the "1/2 mile stretch") were scheduled for removal commencing in late summer/early fall 1999 and expected to be completed by June 2001. In 1999, however, additional dense non-aqueous phase liquids (DNAPL) were found at sites along the river in the "1/2 mile stretch". Prior to initiating the cleanup effort additional source control measures in the form of sheetpiling, and the installation of additional recovery wells were implemented to ensure that sources of contamination to the river (both Light NAPL and DNAPL) would be contained. Source control activities were undertaken in the East Street Area II, Newell Street Parking Lot and the Lyman Street Parking Lot sites. These measures were required to prevent recontamination of the river by sources adjacent to the river after the excavation and capping effort in the river is completed (Steenstrup 1999). Due to the segmented nature of the cleanup activities, the magnitude of PCB contamination in the river is ever changing.

WITHDRAWALS AND DISCHARGES

WMA:

1. WMA Reg. #10207002 for Crane & Co., Inc. to withdraw a total of 2.97 MGD of water from three surface water intakes (two at the Byron Weston and one at the Pioneer Mill) and seven groundwater wells.
2. WMA Permit #9P10223601 for Altresco Pittsfield L.P., to withdraw a total of 1.58 MGD of water from four wells.

NPDES:

1. MAG250956 – issued September 1995 to Crane & Co., Inc. Byron Weston Mill's discharge via outfall #001 of non-contact cooling water to the East Branch Housatonic River. (This discharge was formerly permit # MA0000680 which is now closed.) The facility discharges a maximum of 1.1MGD average monthly flow (1.65 MGD daily maximum flow) with a maximum daily temperature (T) limit of 83°F. . The permit also states that the instream rise in temperature due to the discharge shall not exceed Δ T of 5°F. Outfall # 003 (non-contact cooling water discharge from turbine condenser cooling) is no longer permitted.
2. MAG250955 – issued September 1995 to Crane & Co., Inc. Pioneer Mill discharge via outfall #001 of non-contact cooling water to the East Branch Housatonic River. (This discharge was formerly permit # MA0000663 which is now closed.) The facility discharges 0.576 MGD average monthly flow (0.864 MGD daily maximum flow) with a maximum daily temperature (T) limit of 83°F. The permit also states that the instream rise in temperature due to the discharge shall not exceed Δ T of 5°F.
3. MA0000671 - issued in September 1989 to the Crane & Co., Inc. authorizing the discharge of treated process wastewater via outfall # 001 to the East Branch Housatonic River. Although there is no flow limit in the permit, the discharge ranges between 3.0 and 5.5 MGD. The permit limits for whole effluent toxicity are $LC_{50} \geq 100\%$ and CNOEC $\geq$ 63% effluent. EPA and DEP are currently developing a new permit.
4. MA0035718- issued in September 1993 to Lockheed Martin and subsequently transferred to General Dynamics Defense Systems, Inc. (GDDS) authorizing the discharge via outfall #011 of ordnance plant treated process water, non-contact cooling water, cooling tower blowdown and stormwater runoff to the East Branch Housatonic River. This permit was terminated on 16 February 1999 by EPA since GDDS discontinued all process discharges to outfall #011-1, 011-T, 012-1 and 12-T and physically

removed outfalls 011-G and 012-G (LeBeau 1999). Remaining stormwater discharges are currently permitted under the Multi-Sector General Stormwater Permit # MAR05B285.

5. MA0003891 - issued in May 1992 to the General Electric Company (GE), Pittsfield authorizing the discharge of the following:

   *Outfall #001-for a maximum daily flow up to 2.55 MGD of non-contact cooling water and stormwater runoff into Silver Lake,
   *Outfall #004- for a maximum daily flow up to 2.09 MGD of contact and non-contact cooling water and stormwater runoff into Silver Lake,
   *Outfall #005- for a maximum daily flow up to 1.08 MGD of contact and non-contact cooling water, treated process wastewater, treated groundwater and stormwater runoff into the East Branch Housatonic River,
   *Outfall #007- report the maximum daily and average monthly discharge of non-contact cooling water and stormwater runoff into the East Branch Housatonic River with a maximum daily temperature limit of 75°F,
   *Outfall #009- report the maximum daily and average monthly discharge of non-contact cooling water, treated process water and stormwater runoff into Unkamet Brook, and
   #Outfalls 05A and 006- monitoring of the maximum daily discharge of non-process water from the operation of barrel screens to the East Branch Housatonic River.

   *Note: Denotes that a composite sample will be made by combining discharges from these outfalls and outfall #011 in NPDES permit MA0035718 for Lockheed Martin into a 24-hour proportionate-to-flow composite sample. This composite sample shall be tested for acute and chronic toxicity. The acute toxicity tests are to be conducted monthly with a NOAEL (where 90% or more of the test organisms survive after 48 hours) is $\geq$ 35% effluent. (One acute test per quarter, however, is to be conducted under wet weather conditions -- a monitoring only requirement.) The results of the chronic tests conducted in July, August, and September are to be reported only (no limit).

   Only outfalls #005 and 009 currently discharge from MA0003891. Stormwater discharges are covered under the general stormwater permit MAR05A021. Tentatively, this NPDES permit will be reissued in 2000.

Stormwater (facilities listed in Berkshire Regional Planning Commission 1999 unless otherwise noted):

1. MAR00B300 Test Track Garage General Defense Systems Inc. General Dynamics in Dalton.
2. MAR00B298 OP8 General Defense Systems Inc. General Dynamics in Dalton.
3. MAR00B299 OP3 General Defense Systems Inc. General Dynamics in Pittsfield.
4. MAR00A214 General Electric Company Lyman Street Parking Lot in Pittsfield.
5. MAR05B184 Pittsfield Generating Co. LP in Pittsfield.
6. MAR00A796 Altresco Pittsfield LP in Pittsfield.
7. MAR05B199 Berkshire Regional Transportation Authority in Pittsfield (MA DEP 2000b).
8. MAR05A537 The Lane Construction Corporation in Pittsfield.
9. MAR05A010 The USPS Springfield District, Pittsfield VMF in Pittsfield.

USE ASSESSMENT

Artificial substrate sampling devices were deployed in triplicate by DEP DWM biologists both upstream (station 21-EBH01) and downstream (station 21-EBH02) of the Crane & Co., Inc. WWTP discharge in August 1997(Appendix B, Table B1). The samplers were left instream for approximately six weeks, during which time the substrates were colonized by invertebrates, and were retrieved in October 1997. A comparison of the invertebrates found at the downstream station to those upstream was conducted to evaluate differences in these communities that might be attributable to the discharge. Whole effluent toxicity testing data from Crane & Co., Inc. (required by their NPDES permit) from February 1993 and 1999 was also reviewed (Dallaire 2000). The last dam owned by Crane & Co., Inc. is located on the East Branch Housatonic River downstream from their treated process wastewater discharge (approximately 200m upstream of Hubbard Avenue Pittsfield). Downstream from this dam, the East Branch Housatonic River runs adjacent to the Pittsfield landfill and the GE Company Pittsfield (including Lockheed Martin) facility down to its confluence (just downstream of Pomeroy Avenue Bridge) with the mainstem Housatonic River in Pittsfield. PCB data from sediments and biota have been collected by various agencies as part of the GE Company Pittsfield waste site cleanup investigations.

The USGS NAWQA study site (which included both fish tissue and sediment sampling data) on the East Branch Housatonic River was located downstream from the GE Pittsfield facility nearer to the confluence of the East Branch with the mainstem Housatonic River (Harris 1997and Coles 1998).

- Ambient toxicity testing - Survival of the cladaceron, *Ceriodaphnia dubia,* test organisms exposed to East Branch Housatonic River water collected from the bridge on South Street in Dalton for seven days has been >90% in the 25 tests conducted between February 1993 and 1999 (Dallaire 2000). Fathead minnow (*Pimephales promelas)*, test organisms survival has been >83%. Dilution water physical/chemical data from this segment of the river were as follows: pH ranged from 7.2 to 8.3 SU, alkalinity between 32 and 128 mg/L, hardness between 52 and 164 mg/L. Ammonia-nitrogen concentrations were low ranging between <0.02 and 0.84 mg/L. Total suspended solids were generally below detection although two samples analyzed were slightly elevated (29 mg/L). Conductivity ranged from 126 to 322 µmho/cm. These data were generally within the same range of those reported in the GE Pittsfield dilution water samples collected in the East Branch Housatonic River in the upstream segment (MA21-01).

- Bioassessment/Habitat - The Crane & Co., Inc. WWTP discharge was found to be causing moderate impacts to the benthic macroinvertebrate community in the East Branch Housatonic River (Appendix D). The communities were found to be significantly different based on the statistical analysis, and substantially different when the taxa lists and the relative abundances of various organism types found at the two stations were compared. There was an abundance of naidid worms at the downstream station, which are fairly tolerant of low oxygen conditions. None were found at the upstream site. There was a substantial layer of floc on the artificial substrates at the downstream site (Szal 2000). Oxygen transmission through the floc to the substrates was most likely less than optimal, perhaps rendering the substrates inhospitable to organisms that need higher concentrations of dissolved oxygen to survive. No attempt was made to quantify the depth of floc or the distance downstream from the discharge that the floc persisted.

Crane & Co., Inc. WWTP

- Effluent Toxicity Testing: Between February 1993 and 1999, the Crane & Co., Inc. WWTP discharge has generally met the acute whole effluent toxicity limit of $LC_{50} \geq 100$ % (with one exception in the 25 test events) although chronic toxicity (< 63% effluent) has been documented sporadically (Dallaire 2000). The Crane WWTP discharge has induced chronic toxicity to *C. dubia* in seven of the 25 tests events. The CNOEC results in those seven tests ranged from 6.25 to 50% effluent.
- Field sampling observations: On the two occasions in the summer/fall of 1997, DEP DWM biologists observed an abundance of rust-colored floc in the treatment plant clarifiers, coating the discharge canal, and coating the bottom of the streambed downstream of the discharge.

GE Company, Pittsfield

- Effluent Toxicity Testing: The effluent toxicity tests from the GE Company in Pittsfield are conducted on composite samples (flow-weighted) from various outfalls (see above for permit requirements) which actually discharge into three different waterbodies (Unkamet Brook, Silver Lake and the East Branch Housatonic River). Because of this, the whole effluent toxicity testing data cannot be used to evaluate potential instream impacts to the East Branch Housatonic River for the purpose of this water quality assessment report.

- Fishery Management Policy - According to the Western Wildlife District of the DFWELE, there is no management plan for the East Branch Housatonic River due to contamination issues (Bell 1999).

- Sediment Quality - The following data from this segment of the East Branch Housatonic River were collected prior to waste site cleanup remediation activities as described in the segment

description. Total PCB concentrations in the 525 sediment samples (collected to a depth of ≤ 1ft.) analyzed as part of the GE Company Pittsfield waste site cleanup investigations ranged between 0.02 and 9411 PPM dry weight (Stefanosky 1999). Ninety-eight percent of the samples exceeded the L-EL of 0.07 PPM. Forty-nine percent of the samples exceeded the S-EL of 5.3 PPM* and 12% of the samples exceeded the S-EL of 53 PPM*. It should be noted, however, that the majority of the contamination (and sampling) is below the Newell Street Bridge. In the 21 samples collected in the East Branch Housatonic River upstream of Newell Street, total PCB ranged between 0.02 and 1.8 PPM, dry weight. Twenty-four percent of these samples were less than the L-EL of 0.07 and no samples exceeded the S-EL.

Additionally, USGS as part of their NAWQA study, analyzed sediment collected from the East Branch Housatonic River near its confluence with the mainstem Housatonic River. The concentration of total PCB was 13 PPM (Harris 1997). This sediment sample was comprised primarily of sand (87%) and silt (12%).

*Note: The S-EL guideline for PCB varies depending on the total organic carbon content (TOC) in the sample. Results have been summarized above using a conservative TOC estimate of 1% (where the S-EL = 5.3 PPM) and the maximum guidance allowable TOC of 10% (where the S-EL = 53 PPM).

Several heavy metals (Cu, Pb, Hg, and Ni) in East Branch Housatonic River sediment collected as part of the GE Company Pittsfield waste site cleanup investigations between Center Pond and Hubbard Avenue exceeded the L-EL guidance in Persaud *et al.* 1993 (Blasland, Bouck & Lee, Inc. 1996). Between the "boomed" area near East Street and the Pomeroy Avenue Bridge over the East Branch Housatonic River the following metals also exceeded the L-EL guidance: As, Cu, Cr, Hg, Ni, Pb and Zn. Both Cu and Pb exceeded the S-EL guidance (as high as 129 and 15,500 PPM, respectively) in sediment collected at the Lyman Street Bridge. Similar results were documented in the USGS NAWQA study (Harris 1997). These concentrations were also "enriched" (enrichment ratios or ERs > 1 based on normalization to aluminum concentration) above average crustal concentrations.

- Tissue Chemistry - Fish tissue burdens of total PCB in sunfish, yellow perch, and bass collected approximately from the outlet of Center Pond and downstream of the Hubbard Avenue Bridge (station F1B) in 1980 and 1982 were as high as 2.7 PPM (Stewart Laboratories, Inc. 1982). The concentration of PCB in the trout sample collected in 1982 was 135 PPM.

  NAQWA - The concentration of PCB in the whole fish composite sample (comprised of eight white suckers, *Catastomas commersoni*) was 55,000µg/kg wet weight (Coles 1998). This level of PCB greatly exceeded (110 times) the NAS/NAE guideline for total PCB (in Coles 1998) of 500µg/kg wet weight for the protection of fish-eating wildlife.

  EPA initiated an Ecological Risk Assessment investigation that included sampling of river biota at a variety of trophic levels (including fish, frogs, and ducks) in 1998. The results of this ongoing investigation are not yet available.

Based on the high survival of organisms exposed to East Branch Housatonic River water, the *Aquatic Life Use* is assessed as support upstream of the Crane WWTP discharge. Downstream from the Crane & Co. Inc., WWTP discharge, the *Aquatic Life Use* is assessed as non-support due to moderate impacts to the benthic macroinvertebrate community (attributable to the discharge) and severe PCB sediment contamination (from the GE Pittsfield facility).

- Fish Consumption Advisory – The state issued a fish consumption advisory for the Housatonic River in 1982. The advisory recommended that the general public should not consume fish, frogs and turtles from the Housatonic River between Dalton and Sheffield because of PCB contamination. In 1995, DPH updated their advisory to include a recommendation that fish taken from feeder streams to the Housatonic River should be trimmed of fatty tissue prior to cooking (MA DPH 1999). Because of this advisory, the *Fish Consumption Use* is not supported in this segment of the East Branch Housatonic River.

- Aesthetics – Downstream from the Crane & Co., Inc. WWTP discharge, floc was observed coating the streambed of the East Branch Housatonic River (Szal 2000). The spatial extent of this problem was not determined. Further downstream, the East Branch Housatonic River has been impaired in the past by oil sheens and visual turbidity problems in the reach between the confluence with Unkamet Brook and the confluence with the mainstem Housatonic River in Pittsfield. Although sheens have diminished considerably in frequency, during the past year the GE Pittsfield Company remediation activities have been initiated in the "½ mile stretch" between Newell Street and Lyman Street (Steenstrup 2000). Additionally DNAPL have been found in the "½ mile stretch" during the ongoing river cleanup activities. Due to the remedial actions underway in the East Branch Housatonic River, the *Aesthetics Use* is not assessed at this time.

Designated Use		Status: East Branch Housatonic River (Segment MA21-02)
Aquatic Life		SUPPORT. The upper 2.3 mile reach of this segment is evaluated as supporting this use. NON-SUPPORT. The lower 5.6 mile length of the segment does not support the use as a result of the Crane and Company, Inc. WWTP discharge and the severe sediment contamination problem with PCB from the GE Pittsfield facility.
Fish Consumption		NON-SUPPORT. The entire 7.9 miles of this segment of the East Branch Housatonic River does not support this use because of the DPH fish consumption advisory against eating fish, frogs and turtles in all towns from Dalton to Sheffield because of PCB contamination.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		NOT ASSESSED.

RECOMMENDATIONS: EAST BRANCH HOUSATONIC RIVER (SEGMENT MA21-02)

- The DPH fish consumption advisory to eat no fish, frogs and turtles from the Housatonic River from Dalton to Sheffield because of PCB contamination results in the *Fish Consumption Use* being assessed as non-support. Whether or not the biota in the East Branch Housatonic River upstream of the Crane & Co., Inc. dams (which pose a barrier to fish migration) are contaminated by PCB is currently being investigated by EPA as part of their Ecological Risk Assessment. The DPH should review the results of this investigation and adjust the fish consumption advisory as needed.
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and pages IV-41-44) should be reviewed to help design future monitoring plans for East Branch Housatonic River subwatershed.

RECOMMENDATIONS - Continued: EAST BRANCH HOUSATONIC RIVER (Segment MA21-02)

Crane & Co., Inc. WWTP:

- Crane & Co., Inc. should substantially reduce the amount of floc being discharged by their WWTP into the East Branch Housatonic River. A concentration-based limit for TSS should be considered for their next NPDES permit. It is highly likely that the solids in the wastewater discharge are having a negative effect on the benthic macroinvertebrate community (Szal 2000).
- The Crane & Co., Inc. NPDES permit requirements for whole effluent toxicity testing should be reduced to one organism (*C. dubia)* which has been the more sensitive test organism (one exception in 25 tests). The analysis of several effluent variables can also be eliminated in the toxicity testing requirements: Ag, Cd, Cr, Ni, Pb, Cn, and phenols. Although some chronic toxicity has been present in the effluent, DEP DWM personnel recommend that the solids issue should be addressed prior to toxicity issues (Szal 2000).
- The non-contact cooling water permits MAG250956 and MAG250955 for Crane & Co., Inc. should contain monitoring requirements (in development) to evaluate whether or not water quality standards are being met with regard to temperature.

GE Company Pittsfield:

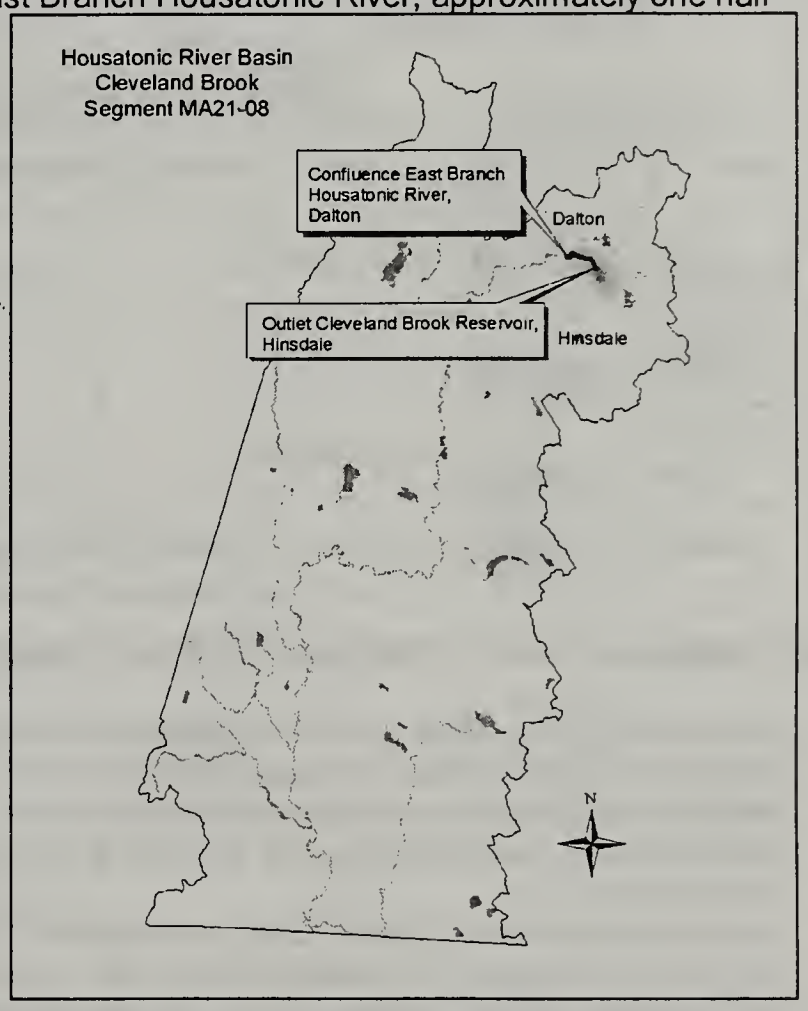
- The GE Company Pittsfield NPDES permit requirements for effluent toxicity testing need to be revised. Each outfall of concern should be tested individually (no flow-weighted composite samples of various outfalls). Permit limits should be developed that are consistent with the Massachusetts Water Quality Standards Implementation Policy for the Control of Toxic Pollutants in Surface Waters. Two test organisms, *C. dubia* and *P. promelas,* should be required.
- Continue to monitor the effectiveness of the GE Company Pittsfield waste site cleanup activities and document these results in a comprehensive report including data and analyses.
- EPA is in the process of collecting additional data on river sediments and bank soils from Dalton through Sheffield, although this data is not yet available (expected sometime in 2000). EPA has also been collecting considerable data (sampling in 1998 and 1999) on river biota at a variety of trophic levels (including fish, frogs, and ducks) as part of their Ecological Risk Assessment. Additional data may also be collected in 2000. Review and evaluate these data when available.

CLEVELAND BROOK (SEGMENT MA21-08)

Location: Outlet Cleveland Brook Reservoir, Hinsdale to confluence with East Branch Housatonic River, Dalton. Segment Length 2.3 miles. Classification: Class B.

SEGMENT DESCRIPTION

This Class B brook flows in a generally north then westerly direction from the outlet of the Cleveland Brook Reservoir in Hinsdale to its confluence with the East Branch Housatonic River, approximately one half mile upstream of Center Pond in Dalton. The brook flows through the Wahconah Country Club in its lower reach.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	76%
Residential and Open Land	6%
Wetlands and Agriculture	2%

Land-use estimates in the 100' riparian zone from the streambanks:

Open Land	21%
Residential	19%
Agriculture	6%

WITHDRAWALS AND DISCHARGES

An unknown volume of water is withdrawn by the Wahconah Country Club which is neither registered nor permitted (Prendergast 1999).

WMA:

1. The Pittsfield Water Department is registered (10223601) to withdraw 13.5 MGD of water from six reservoirs (Lower Ashley Intake, Sandwash, Farnham, Sackett, Ashley Lake and Cleveland). Cleveland Reservoir, Pittsfield Water Department's primary source, has a safe yield of 9.4MGD (14.5 cfs) and an average use of approximately 7.5-8.0 MGD (11.6 - 12.4 cfs) (Prendergast 1999).

USE ASSESSMENT

The following information has been excerpted from the *1992 Housatonic River Tributary Biomonitoring Survey Assessing instream impacts to biota from surface water supply withdrawals* report (Kennedy *et al.* 1993).

> The first order tributary from the outlet of Cleveland Reservoir, Cleveland Brook, was sampled on 5 August 1992. The flow appeared to be similar to that which was noted during the July reconnaissance survey. Stream discharge measured 1.3 cfs. The water quality of Cleveland Brook was the most well buffered of all the stations in the Dalton/Hinsdale area. Deposition on the streambed was responsible for the slightly lower habitat score at this station. Deposition appeared to be a result of very steep banks on one side of the stream as well as road sand runoff on the downstream side of the bridge. The benthic macroinvertebrate community was well balanced with a richness of 17 families and the % contribution of the dominant family of only 15. Fish abundance was also excellent at 49.5 fish/100m^2. Eastern brook trout and brown trout (all age classes) dominated the fish population at this station. One longnose dace was also collected, and many YOY (young-of-the-year) dace were observed.
>
> It should also be mentioned here that Cleveland Reservoir receives the total flow of Windsor Brook through an aqueduct; however, this large volume of flow (approximately 22 cfs) was not evident in

Cleveland Brook (approx. 1.3 cfs) at the time of sampling. Cleveland Brook contained flow more representative of a first order stream with a relatively small drainage area (3.3 km^2).

Although no sampling has been conducted in Cleveland Brook by DWM since 1992, conditions are believed to be similar since the upper watershed is protected as a public surface water supply.

- Fishery Management Policy – According to Western Wildlife District of the DFWELE, there is no management policy for Cleveland Brook, however it is classified as a coldwater, stable fishery (Bell 1999).

Designated Use		Status: Cleveland Brook (Segment MA21-08)
Aquatic Life		SUPPORT. The entire 2.3 mile length of this segment is evaluated as supporting this use.
Fish Consumption		NOT ASSESSED.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		SUPPORT. The entire 2.3 mile length of this segment is evaluated as supporting this use.

RECOMMENDATIONS: CLEVELAND BROOK (SEGMENT MA21-08)

- If the DFWELE endorses, in the next revision of the Massachusetts Surface Water Quality Standards, designate Cleveland Brook as a Cold Water Fishery.
- Minimize road (sand) runoff using stormwater BMPs.
- Determine volume of withdrawal by Wahconah Country Club. If withdrawal exceeds WMA threshold, develop permit.
- Encourage Wahconah Country Club to participate in a program similar to the National Audubon Society's Cooperative Sanctuary Program that recognizes golf courses that employ ecologically sound land management and conservation of natural resources (Berkshire Regional Planning Commission 1999).
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and pages IV-41-44) should be reviewed to help design future monitoring plans for East Branch Housatonic River subwatershed.

Pittsfield Water Department

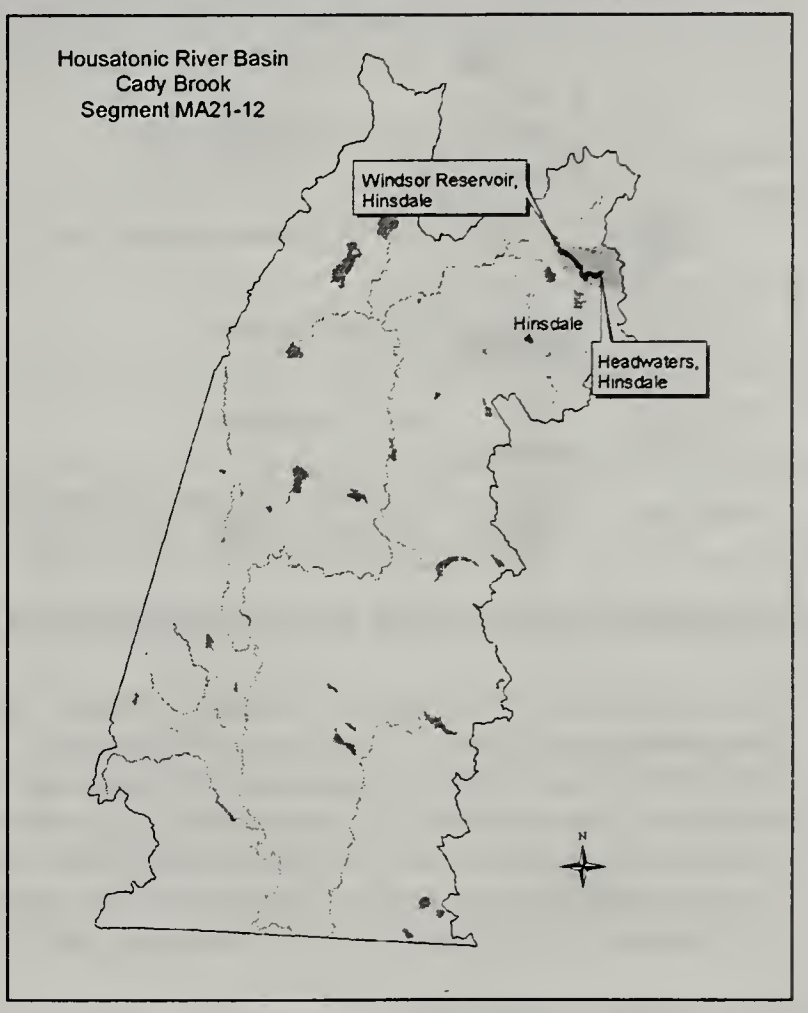
- In 1998, approximately 74% of the Pittsfield Water Department supply was withdrawn from Cleveland Reservoir (LeVangie 2000). The Pittsfield Water Department should implement water conservation/water supply system efficiency recommendations as described in the DEM report entitled *Water Resources of the Housatonic River Basin: Water Use* and *Hydrology* (MA DEM 1999).

CADY BROOK (SEGMENT MA21-12)

Location: Source, Peru to Windsor Reservoir, Hinsdale. Segment Length: 3.5 miles.
Classification: Class A.

SEGMENT DESCRIPTION

Cady Brook originates in a small wetland in the northeast corner of Peru. This Class A stream meanders in a generally northwesterly direction through northern Hinsdale. An aqueduct is located on Cady Brook near a small impoundment approximately 0.5 miles upstream of Windsor Reservoir. The aqueduct diverts water into Cleveland Brook Reservoir.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	96%
Open Land	2%
Wetlands and Residential	5%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	89%
Wetlands	10%
Open Land	1%

WITHDRAWALS AND DISCHARGES

WMA:

1. The City of Pittsfield owns two aqueducts one of which draws water from Cady Brook. These aqueducts are very old and have never had any withdrawal restrictions (Prendergast 1999). The water is directed into Cleveland Reservoir. In 1998 the Pittsfield Water Department withdrew 7.89 MGD of water from Cleveland Reservoir out of a system-wide total of 10.67MGD (LeVangie 2000).

USE ASSESSMENT

The following information has been excerpted from the *1992 Housatonic River Tributary Biomonitoring Survey Assessing instream impacts to biota from surface water supply withdrawals* report (Kennedy *et al.* 1993). Sampling of Cady Brook was conducted off of New Windsor Road in Hinsdale (upstream of the aqueduct withdrawal).

> Cady Brook, a small third order tributary with a drainage area of 7.5 km^2, was sampled as a regional reference station on 5 August 1992. Stream flow (3.8 cfs) appeared to have subsided some from the previous day's heavy rains. Although hardness and alkalinity were still low, pH was near neutral (6.8). Habitat was rated as excellent overall, although there appeared to be a slight lack of defined pools and streamside cover. The macroinvertebrate community appeared to be evenly distributed and rich in intolerant organisms. Three species of fish were collected. Species present, in order of abundance, included eastern brook trout, blacknose dace and one brown trout. Although only one brown trout was collected, it appeared to be a native fish, as it was much smaller (approximately 100 mm in length) than those normally stocked by the Massachusetts Division of Fisheries and Wildlife (MDFW). A total of fifty eight fish (not including YOY) were collected in this reach (39 fish/100m^2), and it was obvious that many YOY dace were passing through the nets.

Although no sampling has been conducted in Cady Brook by DWM since 1992, conditions are believed to be similar since the watershed is protected as a public surface water supply.

- Fishery Management Policy – According to Western Wildlife District of the DFWELE, there is no management policy for Cady Brook which was last stocked with rainbow trout in 1974 (Bell 1999). Fish sampling in 1995 confirmed the presence of slimy sculpin and brook trout. The stream is classified as a coldwater, stable fishery.

Designated Use		Status: Cady Brook (Segment MA21-12)
Aquatic Life		SUPPORT. The upper 3.0 mile length of this segment is evaluated as supporting this use. NOT ASSESSED. The lower 0.5 mile length of this segment is not assessed.
Fish Consumption		NOT ASSESSED.
Drinking Water		The DEP Drinking Water Program maintains current drinking water supply data.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		SUPPORT. The upper 3.0 mile length of this segment is evaluated as supporting this use. NOT ASSESSED. The lower 0.5 mile length of this segment is not assessed.

RECOMMENDATIONS: CADY BROOK (SEGMENT MA21-12)

- Designate Cady Brook as a Cold Water Fishery, with DFWELE support, in the next revision of the Massachusetts Surface Water Quality Standards.
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and pages IV-41-44) should be reviewed to help design future monitoring plans for East Branch Housatonic River subwatershed.

Pittsfield Water Department

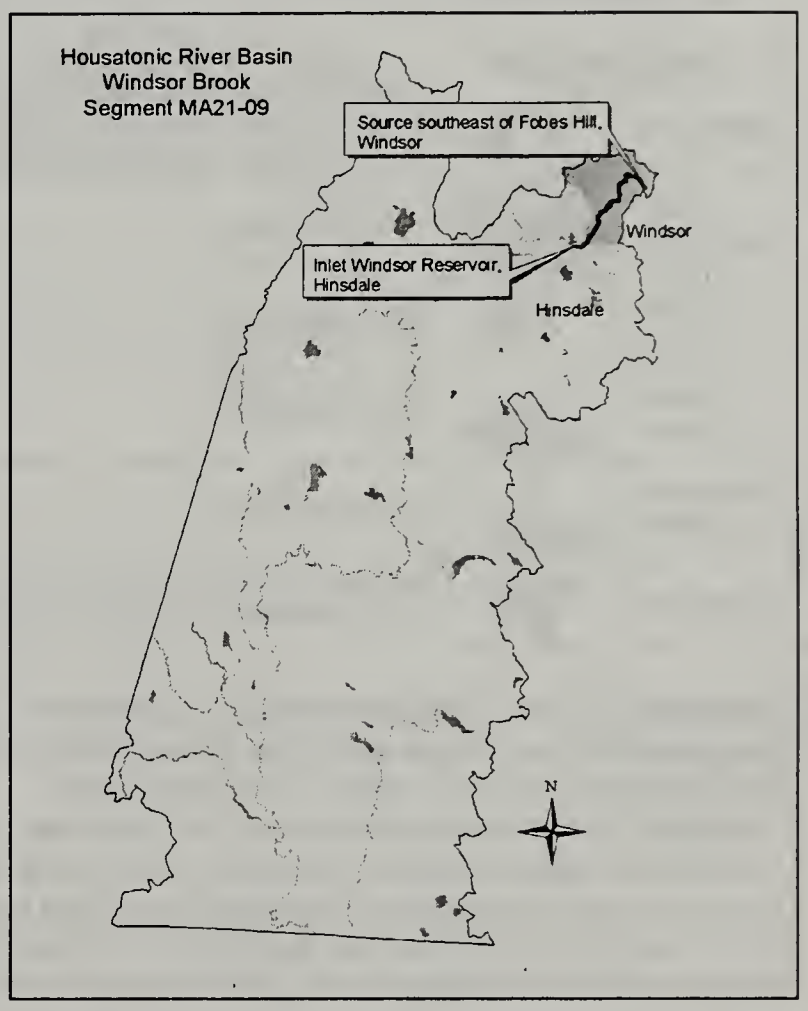
- Determine how much water the Pittsfield Water Department withdraws from Cady Brook via the aqueduct. In 1998, approximately 74% of the Pittsfield Water Department supply was withdrawn from Cleveland Reservoir. The actual volumes from the Cady and Windsor Brook aqueduct sources are currently unknown.
- Optimize the aqueduct withdrawal practices to maintain a minimum streamflow in Cady Brook. This should be a priority for the Pittsfield Water Department which is currently well below their registered volume of 13.5 MGD.
- Collect additional data to document the frequency, duration and severity of low-flow conditions and occurrences of de-watered streambeds below the aqueduct withdrawal on Cady Brook. Document this information via photographs and/or stream depth and velocity measurements.
- DEP DWM should explore the necessity of the Pittsfield Water Department filing for a WMA permit for these aqueduct diversions.
- The Pittsfield Water Department should implement water conservation/water supply system efficiency recommendations as described in the DEM report entitled *Water Resources of the Housatonic River Basin: Water Use* and *Hydrology* (MA DEM 1999).

WINDSOR BROOK (SEGMENT MA21-09)

Location: Source, southeast of Fobes Hill (west of Savoy Hollow Road), Windsor to the Windsor Reservoir, Hinsdale. Segment Length: 5.6 miles. Classification: Class A.

SEGMENT DESCRIPTION

Windsor Brook, a Class A waterbody, originates in the Windsor State Forest and flows in a generally southwesterly direction towards Hinsdale. An aqueduct is located on Windsor Brook approximately 0.2 miles upstream of Windsor Reservoir. The aqueduct diverts water into Cleveland Brook Reservoir.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	84%
Wetlands and Residential	3%
Open Land	2%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	73%
Wetlands	19%
Agriculture	7%

WITHDRAWALS AND DISCHARGES

WMA:

1. The City of Pittsfield owns two aqueducts one of which draws water from Windsor Brook. These aqueducts are very old and have never had any withdrawal restrictions (Prendergast 1999). The water is directed into Cleveland Reservoir. In 1998 the Pittsfield Water Department withdrew 7.89 MGD of water from Cleveland Reservoir out of a system-wide total of 10.67MGD (LeVangie 2000).

USE ASSESSMENT

The following information has been excerpted from the *1992 Housatonic River Tributary Biomonitoring Survey Assessing instream impacts to biota from surface water supply withdrawals* report (Kennedy *et al.* 1993).

> Windsor Brook, a large third order stream (drainage area = 24.6 km^2), is currently being diverted into Cleveland Reservoir. This regional reference site had a streamflow of 22.5 cfs on 5 August 1992 that appeared consistent with what was noted during the July reconnaissance survey. The stream appeared to be better buffered in comparison to the Egypt Brook and Anthony Pond Brook systems with an alkalinity of 27 mg/L as $CaCO_3$ and a pH of 7.5. The habitat was excellent, although the canopy was primarily open at the site. The benthos were found to be diverse and well-balanced with the dominant family comprising only 21% of the sample. Electroshocking efficiency was rated poor (<50% pick-up) due to the width of the stream. Two electroshocking units would have been more appropriate at this site. Eastern brook trout dominated the collection at this station. One longnose dace was collected, however, due to the poor electrofishing efficiency, other longnose dace and additional species may have been present in Windsor Brook.
>
> The aqueduct on Windsor Brook, which supplies water to Cleveland Reservoir, has resulted in the elimination of approximately 0.25 miles of the brook. At the time of the field survey at WB01, the entire flow of Windsor Brook (22.5 cfs) was shunted through the aqueduct.

Although no sampling has been conducted in Windsor Brook by DWM since 1992, conditions are believed to be similar since the watershed is protected as a public surface water supply.

- Fishery Management Policy – According to Western Wildlife District of the DFWELE, the current management policy for Windsor Brook consists of spring stocking of brook trout (Bell 1999). No DFWELE survey data is available although the stream is classified as a coldwater, stable fishery.

Designated Use		Status: Windsor Brook (Segment MA21-09)
Aquatic Life		SUPPORT. The upper 5.4 mile length of this segment is evaluated as supporting this use. NON-SUPPORT. The lower 0.2 mile length of the segment does not support the use because of flow alteration (de-watered/dry streambed) below the aqueduct.
Fish Consumption		NOT ASSESSED.
Drinking Water		NOT ASSESSED.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		SUPPORT. The upper 5.4 mile length of this segment is evaluated as supporting this use. NOT ASSESSED. The lower 0.2 mile length of the segment is not assessed

RECOMMENDATIONS: WINDSOR BROOK (SEGMENT MA21-09)

- Designate Windsor Brook as a Cold Water Fishery, with DFWELE support, in the next revision of the Massachusetts Surface Water Quality Standards.
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and pages IV-41-44) should be reviewed to help design future monitoring plans for East Branch Housatonic River subwatershed.

Pittsfield Water Department

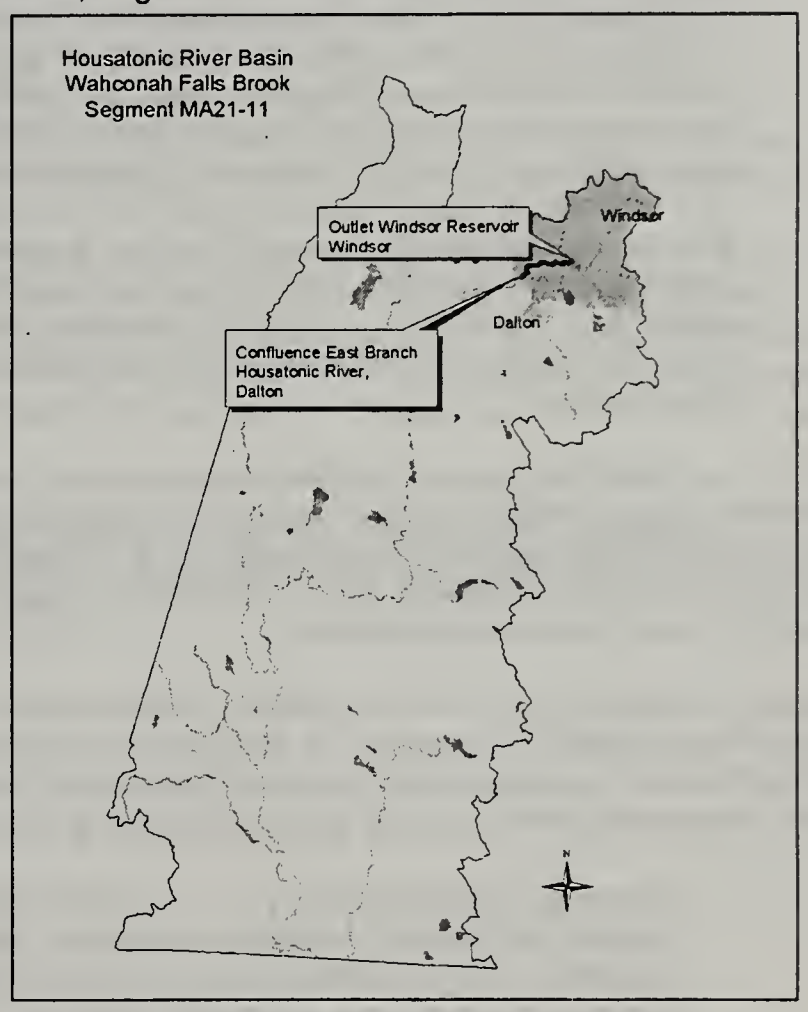
- Determine how much water the Pittsfield Water Department withdraws from Windsor Brook via the aqueduct. In 1998, approximately 74% of the Pittsfield Water Department supply was withdrawn from Cleveland Reservoir. The actual volumes from the Cady and Windsor Brook aqueduct sources are currently unknown.
- Optimize the aqueduct withdrawal practices to maintain a minimum streamflow in Windsor Brook. This should be a priority for the Pittsfield Water Department which is currently well below their registered volume of 13.5 MGD. The Pittsfield Water Department should maintain a minimum streamflow in Windsor Brook downstream of the aqueduct.
- Collect additional data to document the frequency, duration and severity of low-flow conditions and occurrences of de-watered streambeds below the aqueduct withdrawal on Windsor Brook. Document this information via photographs and/or stream depth and velocity measurements.
- DEP DWM should explore the necessity of the Pittsfield Water Department filing for a WMA permit for these aqueduct diversions.
- The Pittsfield Water Department should implement water conservation/water supply system efficiency recommendations as described in the DEM report entitled *Water Resources of the Housatonic River Basin: Water Use and Hydrology* (MA DEM 1999).

WAHCONAH FALLS BROOK (SEGMENT MA21-11)

Location: Outlet of Windsor Reservoir, Windsor to confluence with East Branch Housatonic River, Dalton.
Segment Length: 2.7 miles. Classification: Class B.

SEGMENT DESCRIPTION

Wahconah Falls Brook, a Class B High Quality Water, originates at the outlet of Windsor Reservoir in Windsor. The brook flows in a westerly direction through plunge pools and waterfalls along the upstream end of the reach which are part of the Wahconah Falls State Park. The brook continues to flow in a westerly direction and is joined by Weston Brook from the north. From here Wahconah Falls Brook meanders through some agricultural land area, crosses Route 9/8A and picks up flow from the unnamed stream draining Egypt Reservoir, crosses 9/8A again and receives the flow from Anthony Brook. Wahconah Falls Brook then flows into the East Branch Housatonic River at Center Pond in Dalton.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	84%
Agriculture	7%
Residential	4%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	48%
Agriculture	27%
Wetlands	11%

WITHDRAWALS AND DISCHARGES

WMA:

1. The Dalton Fire District is registered (10207003) to withdraw 0.67 MGD of water from three sources: Anthony Pond and Windsor and Egypt reservoirs. Cleveland Reservoir was removed as a source of water for the District in January 1999 (Prendergast 2000). In 1998 the Dalton Fire District withdrew 0.464 MGD from their three sources as follows: 0.014 MGD from Anthony Pond (locally known as the Anthony Brook Reservoir), 0.273 MGD from Egypt Reservoir, and 0.177 MGD from Windsor Reservoir. Although the District has utilized Egypt Reservoir more heavily within the last few years, Windsor Reservoir is considered the District's primary source. In addition, the District is also allowed at least 0.69 MGD from the Pittsfield Water system through the Cleveland Reservoir system. In 1998 they obtained a total of 1.678 MGD from the City Pittsfield (LeVangie 2000).
2. The Dalton Fire District also has a well source (PWS #1070000-01G) which supplies a mobile home park located just below Windsor Reservoir. The well has a safe yield of 15 GPM. In 1998 the average annual withdrawal was 0.0098 MGD (LeVangie 2000). Since the withdrawal volume of the Trailer Park well is below 100,000 GPD (way below), the well is not subject to the WMA provided the Dalton Fire District overall use does not exceed 0.77 MGD (LeVangie 2000).

USE ASSESSMENT

The following information has been excerpted from the *1992 Housatonic River Tributary Biomonitoring Survey Assessing instream impacts to biota from surface water supply withdrawals* report (Kennedy *et al.* 1993).

> Wahconah Falls Brook, a medium sized third order stream (drainage area = 14.7 km^2) was sampled on 5 August 1992. Streamflow was about half that of Windsor Brook, at 11.3 cfs. Although pH was slightly low (5.7), water quality was quite similar to that of Windsor Brook as the stream had an alkalinity and hardness of 28 and 34 mg/L as $CaCO_3$, respectively.... Benthic samples collected from this station appeared to indicate a well-balanced invertebrate community with the dominant taxon contributing only 17% and a taxa richness of 21 families. Stream conditions included slightly colored water, a totally enclosed canopy, and slick substrates that made electroshocking difficult; however, this station still produced the most diverse fish assemblage of all stations sampled. Fish density was also excellent at 19.7 fish/100m^2. Increased productivity, as evidenced by the extensive coverage of the bottom by periphyton, most likely as a result of the proximity of the station to Windsor Reservoir, was probably responsible for the increased species richness and abundance at this station.

At the time of the 1992 survey, nonpoint source pollution problems were evident at the Wahconah Falls State Park parking area. Washout channels filled with sand and silt were present at the lower end of the parking area a result of road erosion and parking lot runoff. While the runoff did not impact the stream reach sampled (the brook was braided and the island separated the stream reach from the erosion area), the erosion problem needs to be corrected.

Although no sampling has been conducted in Wahconah Falls Brook by DWM since 1992, conditions are believed to be similar in the upper 0.9 miles (to the confluence with Weston Brook). Downstream from this confluence, the uses are not assessed because of the change in land-use (residential and/or agricultural development) and the lack of any water quality data.

- Fishery Management Policy – According to Western Wildlife District of the DFWELE, the current management policy for Wahconah Falls Brook consists of spring stocking of brook trout (Bell 1999). DFWELE fish survey data from 1984 reported nine fish species present dominated by longnose and blacknose dace. Brook and brown trout were also present. The stream is classified as a coldwater, stable fishery.

Designated Use		Status: Wahconah Falls Brook (Segment MA21-11)
Aquatic Life		SUPPORT. The upper 0.9 mile length of this segment supports this use. NOT ASSESSED. The lower 1.8 miles are not assessed due to residential and agricultural land-use and a lack of data.
Fish Consumption		NOT ASSESSED.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		SUPPORT. The upper 0.9 mile length of this segment supports this use. NOT ASSESSED. The lower 1.8 miles are not assessed due to residential and agricultural land-use and a lack of data.

RECOMMENDATIONS: WAHCONAH FALLS BROOK (Segment MA21-11)

- Designate Wahconah Falls Brook as a Cold Water Fishery, with DFWELE support, in the next revision of the Massachusetts Surface Water Quality Standards.
- Determine if stormwater runoff is still causing erosion and sedimentation problems at the Wahconah Falls State Park parking area and if it is currently impacting the brook. Implement (design and construct) stormwater BMPs if necessary.
- Determine via a shoreline survey if livestock currently have access to the stream. Evaluate the stability of the streambanks. Where necessary, stabilization/erosion control measures should be developed and implemented (e.g., BMP projects, education/outreach, etc.)
- Collect bacteria samples at sites throughout the segment including the state park swimming area, bracketing tributaries and major changes in land-use (e.g., livestock grazing areas) on multiple dates to establish current conditions.
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and pages IV-41-44) should be reviewed to help design future monitoring plans for East Branch Housatonic River subwatershed.

<u>Dalton Fire District</u>

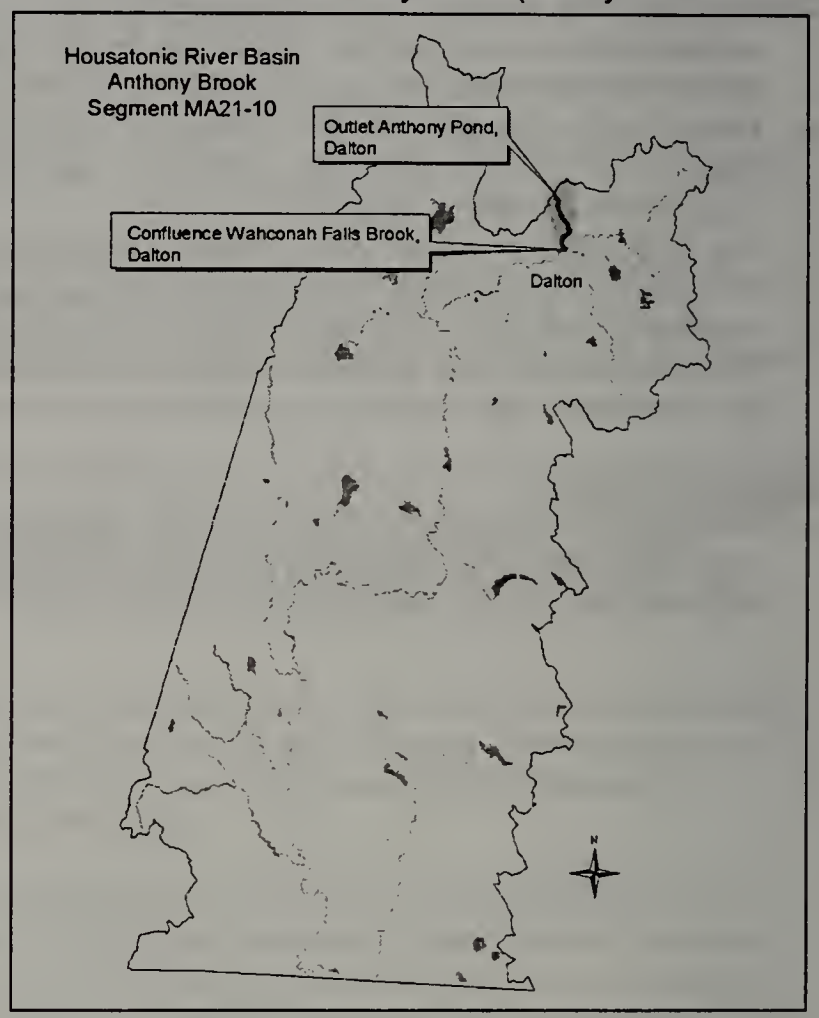
- The Dalton Fire District should implement water conservation/water supply system efficiency recommendations as described in the DEM report entitled *Water Resources of the Housatonic River Basin: Water Use* and *Hydrology* (MA DEM 1999).

ANTHONY BROOK (SEGMENT MA21-10)

Location: Outlet of Anthony Pond (locally known as Anthony Brook Reservoir), Dalton to confluence with Wahconah Falls Brook, Dalton. Segment Length: 2.4 miles. Classification: Class B.

SEGMENT DESCRIPTION

Anthony Brook is a Class B waterbody which originates at the outlet of Anthony Pond (locally known as the Anthony Brook Reservoir) and flows in a southeasterly direction down the southern side of North Mountain. The brook's direction changes as it approaches the base of the mountain near Holiday Road in Dalton. From here Anthony Brook flows southwest, through farmland, and then southeast prior to its confluence with Wahconah Falls Brook just upstream of Center Pond in Dalton. The lower section of this segment has experienced recent housing development.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	90%
Residential	6%
Open Land	1%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	71%
Residential	10%
Agriculture	6%

WITHDRAWALS AND DISCHARGES

WMA:

1. The Dalton Fire District is registered (10207003) to withdraw 0.67 MGD of water from three sources one of which is Anthony Pond. In 1998 the Dalton Fire District withdrew 0.014 MGD from Anthony Pond.

USE ASSESSMENT

The following information has been excerpted from the *1992 Housatonic River Tributary Biomonitoring Survey Assessing instream impacts to biota from surface water supply withdrawals* report (Kennedy *et al.* 1993).

> Anthony Brook, a first order stream that runs parallel to the Egypt Reservoir drainage was also sampled on 4 August 1992. The susceptibility of the stream to acidification was evident from the physicochemical data. Alkalinity was below 1.0 mg/L although the pH was higher (5.3) than at the reference station ER01. Habitat, however, was rated as excellent. The macroinvertebrate community was considered non-impacted although the fish density seemed low (8 fish/100m^2) based on professional judgement in relationship to the available habitat. Eastern brook trout was the only species collected or observed.

Although no sampling has been conducted in Anthony Brook by DWM since 1992, conditions are believed to be similar since the upper watershed is protected as a public surface water supply.

- Fishery Management Policy – According to Western Wildlife District of the DFWELE, there is no management policy for Anthony Brook, however it is classified as a coldwater fishery (Bell 1999).

Designated Use		Status: Anthony Brook (Segment MA21-10)
Aquatic Life		SUPPORT. The entire 2.4 mile length of this segment is evaluated as supporting this use.
Fish Consumption		NOT ASSESSED.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		SUPPORT. The entire 2.4 mile length of this segment is evaluated as supporting this use.

RECOMMENDATIONS: ANTHONY BROOK (SEGMENT MA21-10)

- Designate Anthony Brook as a Cold Water Fishery, with DFWELE support, in the next revision of the Massachusetts Surface Water Quality Standards.
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and pages IV-41-44) should be reviewed to help design future monitoring plans for East Branch Housatonic River subwatershed.

<u>Dalton Fire District</u>

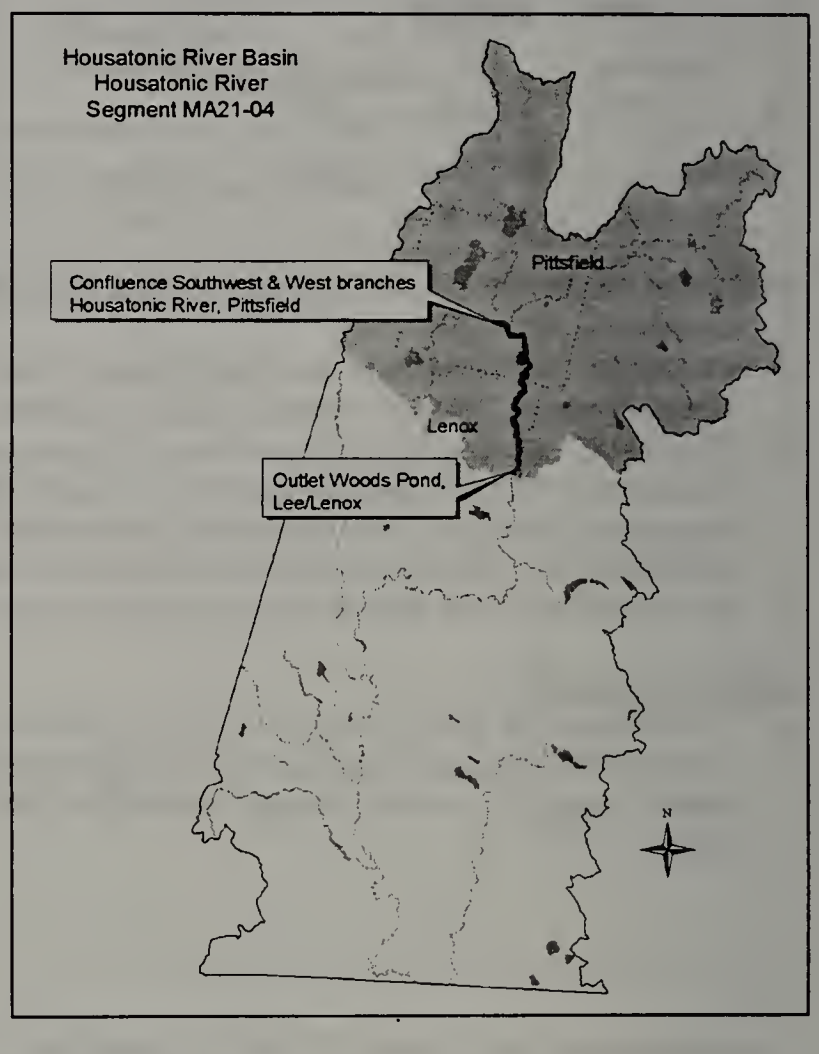
- The Dalton Fire District should implement water conservation/water supply system efficiency recommendations as described in the DEM report entitled *Water Resources of the Housatonic River Basin: Water Use and Hydrology* (MA DEM 1999). They should also optimize the flow into Anthony Brook.

HOUSATONIC RIVER (SEGMENT MA21-04)

Location: Confluence of Southwest Branch Housatonic River and West Branch Housatonic River, Pittsfield to Outlet of Woods Pond, Lee/Lenox. Segment Length: 11.3 miles. Classification: Class B, Warm Water Fishery.

SEGMENT DESCRIPTION

The Housatonic River, a Class B warm water fishery, is formed at the confluence of the Southwest Branch Housatonic River and the West Branch Housatonic River near the southwest side of Pittsfield Center. The river meanders in a southeasterly direction, receives the flow from the East Branch Housatonic River, then picks up the flow from the outlet of Morewood Lake. From here the river continues to meander in a generally easterly direction, then turns and meanders south towards Lenox. The river receives flow from Sackett and Sykes brooks prior to passing by the Pittsfield Municipal Wastewater Treatment Plant, located at the southernmost end of the city of Pittsfield near the Lenox town line. The river continues to meander south, receives flow from Mill and Yokun Brooks, and becomes the municipal boundary between Lee and Lenox. The river then enters and flows through Woods Pond. A new outlet structure, constructed in the late 1980s, has replaced the old dam that was originally built by the Smith Paper Company (Wright and DeGabriele 1975). The Smith Paper Company has since become the P.J. Schweitzer Paper Company and is today the Schweitzer-Mauduit Paper Company. The Housatonic River Valley State Wildlife Management Area and the October Mountain State Forest Area encompass a great deal of land area along the Housatonic River in this segment.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	68%
Residential	10%
Agricultural	8%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	28%
Wetlands	22%
Agriculture	4%

WITHDRAWALS AND DISCHARGES

WMA:
Although there are no direct water withdrawals from this segment of the Housatonic River, the Pittsfield Water Department utilizes surface water from the Sackett and Mill brook subwatersheds that are tributaries to this segment of the Housatonic River. Additionally, Pittsfield Country Club is registered (# 10223603) to withdraw 0.12 MGD from Morewood Lake.

NPDES:

1. MA0101681 – Pittsfield Wastewater Treatment Plant was issued a permit in September 1990 to discharge via outfall #003 of 17MGD average monthly flow (28.7MGD daily maximum flow) of treated sanitary wastewater to the Housatonic River.

USE ASSESSMENT

Artificial substrate sampling devices were installed in triplicate by DEP DWM biologists both upstream (station 21-HR01) and downstream (station 21-HR02) of the Pittsfield POTW discharge in August 1997 (Appendix B, Table B1). The samplers were left instream for approximately six weeks, during which time the substrates were colonized by invertebrates, and were retrieved in October 1997. A comparison of the invertebrates found at the downstream station to those upstream was conducted to evaluate differences in these communities that might be attributable to the discharge (Appendix D).

The Pittsfield WWTP collects water from two locations in this segment of the Housatonic River: winter sampling at the Pomeroy Avenue Bridge in Pittsfield while the spring/summer/fall sampling is from the Housatonic River on the upstream side of the plant property near the old bridge footings. These river water samples are used as dilution water for the Pittsfield POTW effluent toxicity tests. Whole effluent toxicity testing data from the Pittsfield POTW (required by their NPDES permit) between January 1991 and 1999 was also reviewed (Dallaire 2000).

Downstream from the confluence with the East Branch Housatonic River, the mainstem is severely contaminated with PCB from the GE Company Pittsfield. PCB data from sediments and biota have been collected by various agencies as part of the GE Company Pittsfield waste site cleanup investigations (Roy F. Weston, Inc. 1998). Blasland, Bouck, and Lee, Inc. (1999) collected young-of-the-year fish for PCB analysis in 1994 and 1998 from two locations in this segment of the Housatonic River; station HR2 in the vicinity of the confluence with Roaring Brook and station WP1 in Woods Pond.

The USGS NAWQA study sampled one site in Woods Pond for both fish tissue and sediment in this segment of the Housatonic River (Harris 1997 and Coles 1998).

- Bioassessment/Habitat – The benthic macroinvertebrate community analyses for the Southwest Branch (segment MA21-17) and West Branch (segment MA21-18) Housatonic River, (the headwaters of the mainstem Housatonic River), indicated slight/moderate impairment. Habitat quality imitations (severe embeddedness of cobble substrates and degraded instream and riparian habitat conditions) were also observed (Appendix C).

  The DEP DWM analysis of the artificial substrate data found that the invertebrate community downstream of the Pittsfield POTW discharge was 85% comparable to the upstream (reference) station (Appendix D). Differences in the taxa lists were considered minor. Although it was noted that the test station samplers were not always in the direct path of the discharge plume, the discharge did not appear to be causing any impacts to the benthos. Results and the discussion of the benthic macroinvertebrate analysis can be found in Appendix D.

- Ambient toxicity testing –The following data were collected as part of Pittsfield WWTP NPDES permit requirements. Survival of the cladaceron, *Ceriodaphnia dubia,* test organisms exposed to Housatonic River water (7-day) has been ≥90% in the 33 tests conducted between January 1991 and 1999 (Dallaire 2000). Fathead minnow (*Pimephales promelas)*, test organism survival has been ≥87%. Dilution water physical/chemical data from this segment of the river were as follows: pH ranged from 7.3 to 8.0 SU, alkalinity between 33 and 152 mg/L, hardness between 47 and 176 mg/L. Ammonia-nitrogen concentrations were low ranging between <0.02 and 1.0 mg/L. Total suspended solids were generally below detection. The highest measurement was 9 mg/L. Conductivity ranged from 210 to 700 µmho/cm (Dallaire 2000).

- Pittsfield POTW Effluent Toxicity Testing - Between January 1991 and 1999, the Pittsfield WWTP discharge has met the acute whole effluent toxicity limit of LC_{50} ≥100 % and chronic

toxicity limit (CNOEC) of ≥ 50% effluent. The CNOEC results ranged from 75 to 100% effluent.

- Tissue Chemistry - NAQWA - The concentration of PCB in the whole fish composite sample (comprised of eight white suckers, *Catastomas commersoni*) was 72,000µg/kg wet weight (Coles, 1998). This level of PCB greatly exceeded (144 times) the NAS/NAE guideline for total PCB (in Coles 1998) of 500µg/kg wet weight for the protection of fish-eating wildlife. Chlordane was not detected in the white sucker composite sample. The DDT concentration was 260µg/kg wet weight, which did not exceed the NAS/NAE guideline for total DDT (in Coles 1998) of 1,000µg/kg wet weight for the protection of fish-eating wildlife.

  Blasland, Bouck, & Lee, Inc. (1999) - The concentration of PCB in young-of-the-year fish collected at station HR2 ranged between 15,000 and 40,000 µg/kg wet weight (PPB) in largemouth bass, yellow perch, bluegill and pumpkinseed and at station WP1 between 15,000 and 38,000 µg/kg wet weight (PPB) in largemouth bass, yellow perch, and bluegill. All of these data exceed (30 to 80 times) the NAS/NAE guideline for total PCB (in Coles 1998) of 500µg/kg wet weight for the protection of fish-eating wildlife.

- Sediment Chemistry - PCB data from sediments in the mainstem Housatonic River have been collected by various agencies as part of the GE Company Pittsfield waste site cleanup investigations (Stefanosky 1999). Total PCB ranged between 0.028 and 4.2 PPM dry weight in the 26 samples analyzed in sediment samples collected to a depth of ≤ 1 ft. from the confluence of the Southwest and West Branches of the Housatonic River to the confluence of the East Branch Housatonic River. This represents the upper one-mile of the mainstem Housatonic River. Eighty-nine percent of the samples exceeded the L-EL of 0.07 PPM. None of the samples exceeded the S-EL of 5.3 PPM.

  In the reach between the confluence with the East Branch Housatonic River and Woods Pond, total PCB ranged between 0.027 and 278 PPM dry weight in the 376 samples analyzed in sediment samples collected to a depth of ≤ 1 ft. (Stefanosky 1999). Two of the samples were less than or equal to the L-EL of 0.07 PPM. Fifty-eight percent of the samples exceeded the S-EL of 5.3 PPM and 10% of the samples exceeded the S-EL of 53 PPM.

  In Woods Pond, total PCB ranged between 0.07 and 210 PPM dry weight in the 42 samples analyzed in sediment samples collected to a depth of ≤ 1 ft. (Stefanosky 1999). One sample was less than the L-EL of 0.07 PPM while 67 and 36% of the samples exceeded the S-EL of 5.3 and 53 PPM, respectively.

  High concentrations (20 PPM dry weight) of PCB were also measured (sample collected 15 May 1996) as part of the NAWQA study in the sediment of the Housatonic River in Woods Pond (Breault and Harris, 1997).

- Fishery Management Policy – According to Western Wildlife District of the DFWELE, there is no management policy for the Housatonic River (Bell 1999). Tiger muskie introduced originally in Pontoosuc Lake now reside in this stretch of the river, as do northern pike, and are taken in significant numbers, particularly from Woods Pond, through the ice.

The *Aquatic Life Use* in this segment of the Housatonic River is evaluated as non-support. The upper 1.0 mile reach is evaluated as non-support based on the extrapolation of the biological data from the Southwest and West Branch Housatonic Rivers. The *Aquatic Life Use* in the lower 10.3 miles of this segment is evaluated as non-support due to PCB contamination.

- Fish Consumption Advisory - The state issued a fish consumption advisory for the Housatonic River in 1982. The advisory recommended that the general public should not consume fish, frogs and turtles from the Housatonic River between Dalton and Sheffield because of PCB contamination. In 1995, DPH updated their advisory to include a recommendation that fish taken from feeder streams to the Housatonic River should be trimmed of fatty tissue prior to

cooking (MA DPH 1999). Because of the DPH advisory, the *Fish Consumption Use* is not supported in this segment of the Housatonic River.

- Aesthetics - Visual observations of turbidity have been noted along this reach of the Housatonic River by DEP DWM field crew (Appendix B, able B10 - Woods Pond and Appendix D). These observations indicate that in some areas slumped banks were common, as were completely denuded, severely eroded areas. While these conditions are to some extent naturally occurring, they are also most likely exacerbated by stormwater runoff due to urbanization. The *Aesthetics Use* is evaluated as partial support because of instream turbidity.

Designated Use		Status: Housatonic River (Segment MA21-04)
Aquatic Life		NON-SUPPORT. The upper 1.0 mile reach of this segment is evaluated as non-support (extrapolated from the biological assessments in the Southwest and West Branch Housatonic Rivers and the lower 10.3 miles of this segment are evaluated as non-support as a result of PCB contamination.
Fish Consumption		NOT ASSESSED. Between the confluence of the Southwest and West Branches to the confluence of the East Branch (1 mile), this use is not assessed. NON-SUPPORT. Downstream from the confluence of the East Branch Housatonic River to the outlet of Woods Pond (10.3 miles) this use is not supported due to PCB contamination (elevated levels of PCB in frogs, fish and turtles) from the GE Company Pittsfield plant.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		PARTIAL SUPPORT. The entire 11.3 mile length of this segment is evaluated as partial support because of instream turbidity.

RECOMMENDATIONS: HOUSATONIC RIVER (SEGMENT MA21-04)

- Continue to monitor the effectiveness of the GE Company Pittsfield waste site cleanup activities and document these results in a comprehensive report including data and analyses.
- Cleanup goals for the river are currently being finalized in a cleanup agreement between GE Company Pittsfield, EPA and DEP.
- EPA is in the process of collecting additional data on streambed sediments and river bank soils from Dalton through Sheffield, although this data is not yet available (expected sometime in 2000). EPA has also been collecting considerable data (sampling in 1998 and 1999) on river biota at a variety of trophic levels (including fish, frogs, and ducks) as part of their Ecological Risk Assessment. Additional data may also be collected in 2000. Review and evaluate these data when available.
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and pages IV-46) should be reviewed to help design future monitoring plans for the Housatonic River subwatershed.

RECOMMENDATIONS - Continued: HOUSATONIC RIVER (Segment MA21-04)

Pittsfield POTW:

- The Pittsfield NPDES permit requirements for whole effluent toxicity testing should be reduced to one organism, (*C. dubia)*, which has been the more sensitive test organism (three of the test events). The minimum detection limit for the Cu and Pb testing, however, is 0.005 mg/L. The analysis of several effluent variables can also be eliminated in the toxicity testing requirements: Ag, Cd, Cr, Ni, Cn, and phenols.

Pittsfield Water Department:

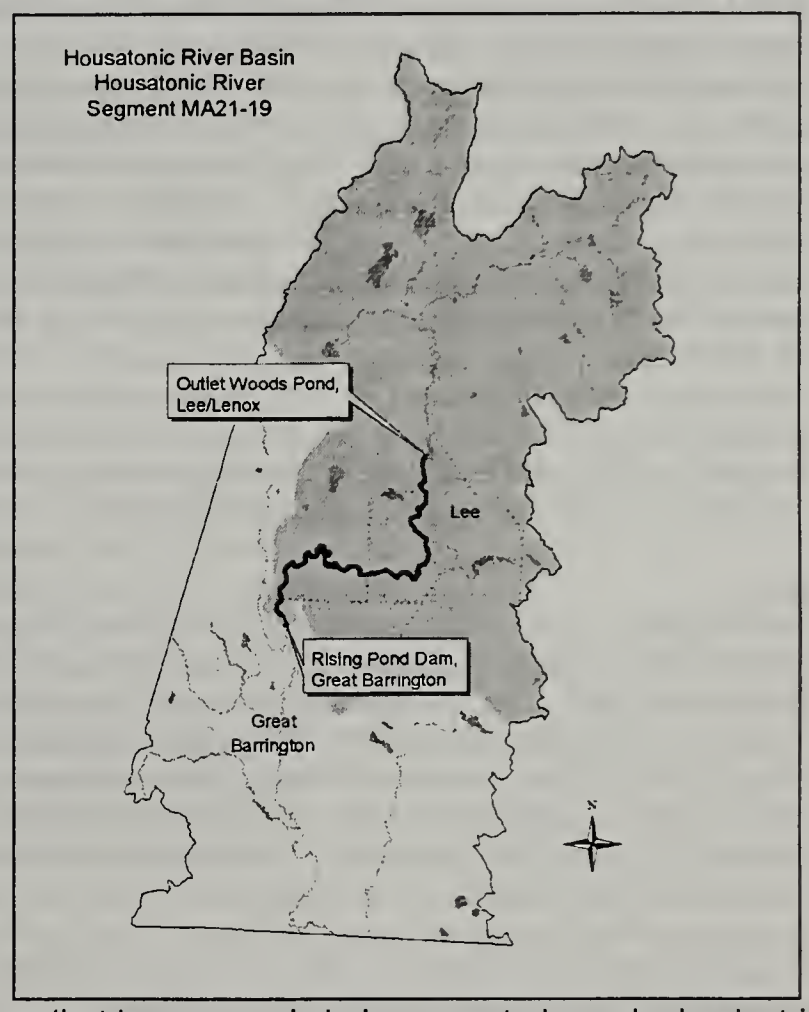
- The Pittsfield Water Department is registered (10223601) to withdraw 13.5 MGD of water from six reservoirs (Ashley Lake, Lower Ashley Intake, Sandwash, Farnham, Sackett, and Cleveland). Effects of these withdrawals on Sackett, Ashley, Mill and Roaring brooks, tributaries to this segment of the Housatonic River, merits further investigation.
- The Pittsfield Water Department should implement water conservation/water supply system efficiency recommendations as described in the DEM report entitled *Water Resources of the Housatonic River Basin: Water Use* and *Hydrology* (MA DEM 1999).

HOUSATONIC RIVER (SEGMENT MA21-19)

Location: Outlet of Woods Pond, Lee/Lenox to the outlet of Risingdale Impoundment, Great Barrington
Segment Length: 20.0 miles. Classification: Class B, Warm Water Fishery.

SEGMENT DESCRIPTION

From the outlet of Woods Pond, the Housatonic River flows south. It receives the flow from the Lenox WWTP, which has recently been upgraded to accept the flow from the Lenoxdale WWTP. The Lenoxdale WWTP has been decommissioned. In Lee, the river slows as it nears the dam at the Columbia Mill of the Schweitzer-Mauduit Paper Company. Just below this dam the Housatonic River enters the Lee business district, south of which it picks up the flow from Goose Pond Brook. The river then receives the discharge from the Lee WWTP and then Hop Brook after which it turns and flows in a westerly direction. The river then is joined by Beartown Brook from the south (draining part of Beartown State Forest) and the Mead Corporation – Specialty Paper Division Laurel Mill discharge on its northern bank. Just before it leaves Lee, the river is slowed down by the Willow Mill Dam at Mead's Willow Mill. Downstream of the dam the river receives the treated discharge of the Willow Mill. The river winds its way west through the center of Stockbridge and receives the discharge from the Stockbridge WWTP just upstream of its confluence with Larrywaug Brook, the outlet stream of Stockbridge Bowl. In western Stockbridge, the velocity of the mainstem is slowed by the dam in Glendale Village that is once again being operated as a hydroelectric facility. Downstream of this dam, the Housatonic River turns south and enters Great Barrington. The Housatonic River enters the village of Housatonic, flows adjacent to the Monument Mills buildings and again becomes impounded by the Rising Pond Dam marking the end of this segment.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	70%
Residential	9%
Agriculture	8%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	29%
Open Land	8%
Wetlands	7%

WITHDRAWALS AND DISCHARGES

WMA:

1. Permit #9P210215002/Registration #10215002 for Schweitzer-Mauduit International, Inc. authorizing a system-wide withdrawal of 6 MGD from three wells (located near the Housatonic River between Woods Pond and Lenoxdale) and two surface waters sources (the Housatonic River near the Columbia Mill and Laurel Lake). Wells #2 and #4, are located near to the outlet of Woods Pond. In 1993, an average of 1.3 MGD was withdrawn from these two sources while more recently (1997 and 1998) slightly less water (1.1 and 1.0 MGD, respectively) has been withdrawn (Prendergast 1999).

The third Schweitzer-Mauduit well #5, installed in 1991, provided 0.5 MGD of water to the paper company. Withdrawals from well #5, which has an approved rate of 1.44 MGD, was as high as 0.88 MGD (1996 average annual withdrawal). The facility typically withdraws just over 2.0 MGD of water from the Housatonic River at the Columbia Mill intake for their operations. Approximately 1.4 MGD of water was withdrawn from Laurel Lake in 1993, while 0.14 and 0.29 MGD of water is discharged via outfalls 007 and 006, respectively (according to the flow schematic for Eagle Mill in the facilities NPDES reapplication file). These estimates indicate that approximately 30% of the water withdrawn from Laurel Lake is overflow. Average annual withdrawals from Laurel Lake between 1995 and 1998 have ranged between 1.0 and 1.2 MGD.

2. Permit #9P10215001/Registration #10215001 for Mead Corporation – Specialty Paper Division. The company withdraws water from a total of six sources (system-wide withdrawal of 3.82 MGD) which supplies their two paper mills. Their sources include the following: two wells (the Boiler House Spring and Morart Warehouse Well) and four surface water sources (two small tributaries to Beartown Brook -- East and West Brooks, an intake from the Housatonic River at "river pumphouse lagoon" at the Laurel Mill and an intake in the basement of the Willow Mill from a canal running underground from the dam at the Willow Mill). The water supply to the Willow Mill includes the Willow Mill Spring (rated for 0.036 MGD, actual average daily withdrawal in 1998 was 0.012 MGD), a withdrawal from the Housatonic River (approved for 1.87 MGD, actual average daily withdrawal in 1998 was 0.81 MGD) and the average annual daily withdrawal from the two tributaries to Beartown Brook, East and West Brooks, in 1998 was 0.42 MGD. The approved rate of withdrawal from these sources is 0.45 MGD. The Morart Well has not been used since 1986.

NPDES:

1. MA0100935 -- The Lenox Wastewater Treatment Plant discharges via outfall #001 0.91MGD average monthly flow of treated sanitary wastewater to the Housatonic River. This permit was issued in December 1985. The facility was recently upgraded to accept the flow from the Lenoxdale WWTP. The tie-in of the Lenoxdale WWTP flow was completed on March 31, 1998.
2. MA0100943 – The Lenoxdale (Plant #2) Wastewater Treatment Plant discharge of 0.28 MGD was eliminated. The plant was decommissioned as of March 31, 1998.
3. MA0005371 – issued September 1989 to Kimberly-Clark Corporation. A transfer of ownership on 30 November 1995 to Schweitzer-Mauduit International, Inc. The facility is engaged in the manufacturing of specialty paper and pulp. The facility is comprised of five mills; Eagle, Niagara, Columbia, Pulp, and Greylock Mills as well as a tailrace lagoon. A brief description of the facility's five discharges (upstream to downstream) follows:
   Outfall #008 – overflow from Niagara Mill fire protection canal
   Outfall #002 – primary wastewater treatment plant effluent from Eagle, Niagara, Columbia Mills as well as the tailrace water. Combined flow of 3.47 MGD to the Housatonic River.
   Outfall #003 – secondary wastewater treatment plant effluent from the Pulp and Greylock Mills of 1.6 MGD to the Housatonic River.
   Outfall #006 – overflow from Laurel Lake, clear well storage
   Outfall #007 – overflow from Laurel Lake, tower storage
   The effluents from outfalls #002 and 003 (the primary and secondary wastewater treatment plant discharges) are flow composited for effluent quality monitoring required in the NPDES permit. The combined effluent limit for acute whole effluent toxicity is LC50 $\geq$100% and the CNOEC limit is $\geq$ 15% effluent. The conventional pollutant limits (BOD, TSS, and phosphorus) are expressed in lbs/day rather than concentration based limitations (mg/L).
4. MA0100153 – The Lee Wastewater Treatment Plant discharges via outfall #001 1.0 MGD (design flow in the 1994 permit) to the Housatonic River. The permit limit for whole effluent toxicity was $LC_{50} \geq$ 100% and the total residual chorine limit was 0.3 mg/L (monthly average) and 0.5 mg/L daily maximum. The dilution available to the facility discharge was 26 MGD (40.4 cfs). This facility is expanding and a new permit will be issued for a discharge of 1.5 MGD of treated wastewater.
5. MA0001911 – The Southdown Corporation (formally Lee Lime Corporation) on Marble Street in Lee discharges to an unnamed swamp. Flow monitoring of the discharge is required in June. The permit expired in 1984 and has been administratively continued.
6. MA0001716 – issued December 1995 to Mead Corporation – Specialty Paper Division – Laurel Mill authorizing the discharge of 2.0 MGD (average monthly flow) of treated paper mill wastewaters, boiler blowdown and excess treated river water via outfall #001 (2.5 MGD maximum daily flow) to the Housatonic River near the railroad trestle crossing. The Laurel Mill also currently discharges

(maximum daily) up to 0.1 MGD of river water filter backwash via outfall #002 to the Housatonic River at the "river pumphouse lagoon". The plant was upgraded in 1998 and the maximum daily discharge via outfall #001 is <2.0 MGD. The permit will be reissued in 2000.

7. MA0001848 – issued December 1995 to Mead Corporation – Specialty Paper Division --Willow Mill authorizing the discharge of 1.5 MGD (average monthly flow) of treated paper mill wastewater and boiler blowdown via outfall #001 (2.0 MGD maximum daily flow) to the Housatonic River downstream from the Willow Mill Dam. The facility plans to upgrade the treatment system in 2000.
8. MA0101087 – The Stockbridge Wastewater Treatment Plant discharges an average of 0.25 MGD (design flow of 0.32 MGD) via outfall #001 to the Housatonic River just upstream of its confluence with Larrywaug Brook in Stockbridge. The facility is operating under their old permit (signed June 1986) until a new permit is reissued. The facility upgraded to UV for disinfection in June 1986. The facility has not yet been required to conduct toxicity tests on their effluent. A Comprehensive Wastewater Management Plan (CWMP) is funded (SRF Project) that should include oil and grease removal issues (currently lacking) and septage waste from Tanglewood and other establishments that hydraulically shock the plant. Infiltration and inflow problems into the sewer collection system is significant and currently being studied. Waste sludge, grit, and screenings continue to be disposed of at the local landfill.

Stormwater:

1. MAR05A884 – Schweitzer-Mauduit International, Inc. Columbia Mill in Lee
2. MAR05A896 – Schweitzer-Mauduit International, Inc. Columbia Mill in Lee
3. MAR05A885 – Schweitzer-Mauduit International, Inc. Eagle Mill in Lee
4. MAR05A897 – Schweitzer-Mauduit International, Inc. Eagle Mill in Lee
5. MAR05A886 – Schweitzer-Mauduit International, Inc. Greylock Mill in Lee
6. MAR05A894 – Schweitzer-Mauduit International, Inc. Greylock Mill in Lee
7. MAR05A887 – Schweitzer-Mauduit International, Inc. Niagara Mill in Lee
8. MAR05A895 – Schweitzer-Mauduit International, Inc. Niagara Mill in Lee
9. MAR05B465 – Mead Corporation Specialty Paper Division Laurel Mill in Lee
10. MAR05B366 – Mead Corporation Specialty Paper Division Willow Mill in Lee
11. MAR05A536 – The Lane Construction Corporation in Lee

Other:

Federal Energy Regulatory Commission (FERC) Permit

1. P-2801 – The Glendale Project is authorized to operate as a "run-of-the-river" plant with no drawdown of the pool behind the existing dam; the outflow below the powerhouse shall at all times be equal to the inflows into the impoundment above the dam. A Water Quality Certification Revision for this hydroelectric facility (formerly known as Monument Mills Hydroelectric facility) was issued by DEP with these clarifications: a) the project be operated with no drawdown of the impoundment behind the existing dam, b) that a minimum of 10 cfs flow required for fisheries be maintained in the 2750 ft. main river channel parallel to the intake canal, and c) that the gates to the intake canal be open only when conditions a and b above are satisfied (McMahon 1986).

USE ASSESSMENT

Artificial substrate sampling devices were installed in triplicate by DWM biologists both upstream (station 21-HR03) and downstream (station 21-HR04) of the Schweitzer-Mauduit Company discharge in August 1997 (Appendix B, Table B1). The samplers were left instream for approximately six weeks, during which time the substrates were colonized by invertebrates, and were retrieved in October 1997. A comparison of the invertebrates found at the downstream station to those upstream was conducted to evaluate differences in these communities that might be attributable to the discharge.

Data from the following facilities who collect river water from this segment of the Housatonic River for use as dilution water in their effluent toxicity tests and have conducted whole effluent toxicity tests as specified in their NPDES permits was reviewed (Dallaire 2000):

- Schweitzer-Mauduit International, Inc. collects water from the inlet before their bar rack intake at the Columbia Mill dam. Data from the Schweitzer-Mauduit International, Inc. facility collected between January 1993 and April 1999 was reviewed.

- Lee WWTP collects water from the Housatonic River between 50 and 100 yards upstream of their WWTP outfall. Data from the Lee POTW between May 1995 and December 1998 was reviewed.
- The Mead Corporation Specialty Paper Division operates two mills on the Housatonic River in South Lee—the Laurel Mill and the Willow Mill. The company collects water from the Housatonic River just upstream of its confluence with Beartown Brook (upstream of both facilities) used as dilution water for both mill's toxicity tests. Whole effluent toxicity testing data from both the Laurel and Willow Mills between July 1995 and March 1999 was reviewed.

The mainstem Housatonic River is contaminated with PCB from the GE Company Pittsfield. PCB data from sediments and biota have been collected by various agencies as part of the GE Company Pittsfield waste site cleanup investigations (Stefanosky 1998). Blasland, Bouck, and Lee, Inc. (1999) collected young-of-the-year fish samples for PCB analysis in 1998 from Glendale Dam.

A compliance review of flow releases at the Glendale Project by the Federal Energy Regulatory Commission was initiated in October 1998 (Springer 2000). Their review included an analysis of project operations and streamflow conditions relating to the Glendale Project license requirements for run-of-river.

- Bioassessment/Habitat – An upstream/downstream evaluation of the Schweitzer-Mauduit International, Inc. outfalls #002/003 was conducted by DWM biologists in the late summer of 1997. The discharge(s) was found to be causing moderate impacts to the benthic macroinvertebrate community. Results and the discussion of the benthic macroinvertebrate analysis can be found in Appendix D. One of the effluent discharges (either outfall 002 or 003) was opaque; resembling clay-colored milk. While water clarity upstream of the discharge was fine, visibility was reduced downstream of the discharge.

  The two other discharges from the Schweitzer-Mauduit International, Inc. facility, outfalls #006 and 007, were located downstream of the benthic macroinvertebrate test station.

- Ambient Toxicity Testing - Schweitzer-Mauduit International, Inc. - The facility collects water from the inlet before their bar rack intake at the Columbia Mill dam in this segment of the Housatonic River. These river samples are used as dilution water for their effluent toxicity tests. Survival of the cladaceron, *Ceriodaphnia dubia,* test organisms exposed to Housatonic River water (7-day) has been ≥70% in the 26 tests conducted between January 1993 and April 1999. Fathead minnow (*Pimephales promelas)*, test organism survival has been ≥80%. Dilution water physical/chemical data from this location were as follows: pH ranged from 7.0 to 8.2 SU, alkalinity between 42 and 152 mg/L, hardness between 47 and 144 mg/L. Ammonia-nitrogen concentrations were low ranging between <0.02 and 0.33 mg/L. Total suspended solids were generally low although two of 27 measurements exceeded 25 mg/L (the highest 190 mg/L). Conductivity ranged from 149 to 482 μmho/cm (Dallaire 2000).

  The Lee WWTP discharges to the mainstem Housatonic River downstream of its confluence with Goose Pond Brook in Lee. The facility collects water for testing from the Housatonic River between 50 and 100 yards upstream of their WWTP outfall. Survival of the cladaceron, *C. dubia,* test organisms exposed to Housatonic River water (48 hour) has been ≥95% in the 14 tests conducted between May 1995 and December 1998. Fathead minnow (*P. promelas)* test organism survival has also been ≥95%. Dilution water physical/chemical data from this location were as follows: pH ranged from 7.6 to 8.3 SU, alkalinity between 74 and 160 mg/L, hardness between 69 and 160 mg/L. Ammonia-nitrogen concentrations were generally low ranging between 0.02 and 0.3 mg/L although one measurement was elevated -- 2.5 mg/L. Total suspended solids were generally low (≤ 12 mg/L) with one exception (55 mg/L). Conductivity ranged from 220 to 588 μmho/cm (Dallaire 2000).

  The Mead Corporation Specialty Paper Division, which operates two mills on the Housatonic River in South Lee--the Laurel Mill and the Willow Mill, collects water for testing from the Housatonic River just upstream of its confluence with Beartown Brook (upstream of the Mead facilities). These river samples are used as dilution water for the effluent toxicity tests for both the Laurel and Willow Mills. Survival of the cladaceron, *Ceriodaphnia dubia,* test organisms exposed to

Housatonic River water (7-day) has been ≥90% in all but one of the 15 tests conducted between July 1995 and March 1999. Fathead minnow (*Pimephales promelas)*, test organism survival, however, has indicated some potential for instream chronic toxicity. Survival of the minnows at 48 hours has been ≥ 90% while survival at the end of the 7-day exposure has ranged between 35 and 100% and survival has been ≤ 70% in almost half of the tests. Dilution water physical/chemical data from this location were as follows: pH ranged from 6.9 to 8.0 SU, alkalinity between 32 and 141 mg/L, hardness between 50 and 166 mg/L. Ammonia-nitrogen concentrations were low ranging between <0.07 and 0.17 mg/L. Total suspended solids were generally low (<5 mg/L) although four of 17 measurements exceeded 25 mg/L. Conductivity ranged from 137 to 538 µmho/cm (Dallaire 2000).

- Effluent Toxicity Testing - The Schweitzer-Mauduit International, Inc. effluent (composite samples of outfalls #002 and 003) has not documented any acute whole effluent toxicity to either *C. dubia* or *P. promelas. C*hronic toxicity to *C. dubia*, however, has been documented with results ranging between <6.25 to 100 % effluent. While 20 of 26 test events indicated some level of chronic toxicity, three of the results did not meet the CNOEC limit of ≥ 15% effluent (Dallaire 2000). The most sensitive test organism has been *C. dubia*.

  The Lee WWTP discharge did exhibit acute toxicity to both *C. dubia* and *P. promelas* in one of 14 test events (LC_{50} = 82 and 71% effluent respectively) and a second *P. promelas* test just met the permit limit LC_{50} = 100%. The most sensitive test organism has been *P. promelas*. The Lee WWTP is presently under a Departmental Consent Order to upgrade the facility. The Lee WWTP has received SRF monies for planning to upgrade the treatment plant and to study I/I. These planning and I/I studies are ongoing under the review of DEP Division of Municipal Services. In addition, Lee has applied for additional SRF Money for the year 2000 period, to be used for construction.

  The Mead Corporation Specialty Paper Division has conducted quarterly toxicity testing on their treated process wastewater effluents from both the Laurel and Willow Mills since July 1995 as required by their NPDES permits MA0001716 and MA0001848. A summary of the toxicity testing data for the mills follows (Dallaire 2000):

	Laurel Mill (MA0001716)		Willow Mill (MA0001848)	
Test Organism	LC50	C-NOEC	LC50	C-NOEC
C. dubia	9.5 - >100%	<6.25 – 100%	<6.25 - >100%	<6.25 – 50%
P. promelas	43.6 - >100%	12.5 – 100%	<6.25 - >100%	<6.25 – 100%

Note: Mead Corporation Specialty Paper Division - Because of acute whole effluent toxicity present in the discharges of both the Laurel and Willow Mills, the Mead Corporation Specialty Paper Division was issued an administrative order by EPA (Docket No. 95-09 for the Willow Mill and 95-10 for the Laurel Mill) requiring that a Scope of Work and Schedule for attaining and maintaining compliance with the limitations and conditions of the NPDES permits. The schedule specifically required the following:

> "Provisions and schedule deadlines for conducting a Toxicity Identification Evaluation (TIE) and a Toxicity Reduction Evaluation (TRE)...the outcome of the TIE and TRE shall be the identification of those pollutants causing acute and chronic toxicity to the effluent and the proposal of remedial action and a schedule for eliminating or treating those pollutants so as to comply with the Permit. Also in the Willow Mill Docket—Provisions and schedule deadlines for attaining and maintaining compliance with the effluent limitation for total zinc contained in the Permit."

The Mead Corporation Specialty Paper Division has conducted the studies and has upgraded their wastewater treatment plant at the Willow Mill (installation completed in December 1998). Acute toxicity is still problematic at the Willow Mill on a very sporadic basis (appears to be associated with a production line infrequently used). The facility is working on solving this issue. The corporate headquarters has also recently approved their request to upgrade their wastewater treatment plant at the Laurel Mill. Construction of the upgrade will be complete by the end of 2000.

Additional environmental issues being addressed by the company: Mead pretreats their river water intake (average annual daily withdrawal of 1.5 MGD in 1998) for use in manufacturing processes at the Laurel Mill facility. Pretreatment consists of chlorination and aluminum sulfate (alum) addition followed by filtration through four sand filter beds. The filters are backwashed and presently discharged back to the Housatonic River via outfall #002. The filter backwash water contains both aluminum and total residual chlorine. In an effort to reduce total suspended solids in the backwash discharge as well as the temperature in the process discharge, Mead has proposed treatment modifications that would eliminate their discharge via outfall #002. Additionally, the facility has proposed to withdraw water from two deep (800') (not installed as of 28 July 1999) to replace their river water intakes. This will supply cooler water to their facilities and reduce the thermal loading of their treated process wastewater discharges, from both mills, to the Housatonic River. The temperature limit in their current permits is 90°F, which both facilities occasionally violate when ambient river temperatures are elevated and streamflow is low. The use of chlorine and alum will also be eliminated.

- Water Quantity - Downstream of the Stockbridge WWTP, the Housatonic River continues to meander in a westerly direction until it enters the village of Glendale. Here the river is dammed at the Glendale Project (FERC P-2801), where the "run-of-the-river" hydroelectric generating facility is operated. Manipulation of streamflow was evident at the USGS gage on the Housatonic River at Great Barrington and at the request of a concerned citizen, FERC initiated a compliance review of the Glendale Project. The FERC compliance review found the Glendale Project operated in violation of run-of-river license requirements on many days in both 1998 and 1999 (Springer 2000). Two separate causes of violations were identified in the compliance review: operator action and equipment deficiencies (automatic controller). While many of the equipment difficulties causing operational problems have been repaired (improved data logging and in July/August 1999 changing the minimum flow release method to ¾" water over the dam crest replacing the dam notch), operator induced violations have not yet been resolved.

- Sediment Chemistry- GE Company Pittsfield waste site cleanup investigations - The concentration of total PCB in surficial sediment (less than 12 inches) of the Housatonic River in Rising Pond (also known as Risingdale Impoundment) ranged from detectable levels to 26 PPM (Blasland, Bouck & Lee, Inc. 1991, 1992 and 1996). The sediment total PCB data in the 1992 Addendum report (the only report that included TOC data) did not exceed the S-EL guideline however all the total PCB data exceeded the L-EL guideline (0.07 PPM).

- Tissue Chemistry- GE Company Pittsfield waste site cleanup investigations (Blasland, Bouck, & Lee, Inc. 1999) – The concentration of PCB in young-of-the-year fish collected at Glendale Dam ranged between 940 and 13,000 µg/kg wet weight (PPB) in largemouth bass, yellow perch, bluegill and pumpkinseed. All of these data exceed (2 to 26 times) the NAS/NAE guideline for total PCB (in Coles 1998) of 500µg/kg wet weight for the protection of fish-eating wildlife.

- Fishery Management Policy – According to Western Wildlife District of the DFWELE, there is no management policy for the Housatonic River (Bell 1999). Although the stretch of river between the Woods Pond Dam and the Columbia Mill Dam in Lee may support rainbow trout (suspected to

have originated from possible upstream sources including the Southwest Branch Housatonic River, the East Branch Housatonic River, and Pontoosuc Lake), DFWELE indicates that anglers avoid fishing in this area because of the DPH fish consumption advisory (Keefe 2000).

The *Aquatic Life Use* is evaluated as non-support because of elevated levels of PCB in fish tissue and sediment as well as toxicity and instream impact(s) due to the NPDES discharges along this segment of the Housatonic River. The *Aquatic Life Use* is also threatened by hydromodification (bypass reach and excessive streamflow fluctuation) downstream of the Glendale Project facility (FERC P-2801).

- Fish Consumption Advisory – The state issued a fish consumption advisory for the Housatonic River in 1982. The advisory recommended that the general public should not consume fish, frogs and turtles from the Housatonic River between Dalton and Sheffield because of PCB contamination. In 1995, DPH updated their advisory to include a recommendation that fish taken from feeder streams to the Housatonic River should be trimmed of fatty tissue prior to cooking (MA DPH 1999). Because of this advisory, the *Fish Consumption Use* is not supported in this segment of the Housatonic River.

- Aesthetics – Upstream of the Schweitzer-Mauduit International, Inc. discharge (the upper 2.6 miles of this segment), water clarity in pooled areas was at least 4' therefore the *Aesthetics Use* is evaluated as support. The effluent from the Schweitzer-Mauduit International, Inc. discharge, however, was completely opaque (resembling clay-colored milk) (Appendix D). The Housatonic River downstream of this discharge was visually turbid (water clarity was approximately 8-12 inches). Visual observations of turbidity have been frequently noted in the past along this reach of the Housatonic River between the Schweitzer-Mauduit International, Inc. discharge and the Mead Corporation Specialty Paper Division Willow Mill dam. In this reach of the river the aesthetic use is evaluated as non-support (6.7 miles). Downstream from this dam in the lower 10.7 miles reach, the *Aesthetics Use* is not assessed.

Designated Use		Status: Housatonic River (Segment MA21-19)
Aquatic Life		NON-SUPPORT. The *Aquatic Life Use* is evaluated as non-support for the entire 20 mile length of this segment because of elevated levels of PCB in fish tissue and streambed sediment as well as impacts associated with NPDES discharges. Hydromodification (streamflow fluctuations) also threatens the biota in the lower 3.6 mile reach (below Glendale Project).
Fish Consumption		NON-SUPPORT. The entire 20 mile length of this segment does not support this use because of elevated levels of PCB in frogs, fish and turtles resulting from the GE Company Pittsfield plant.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		SUPPORT. The upper 2.6 mile reach of this segment supports this use. NON-SUPPORT. Between the Columbia Mill and Willow Mill dams, this use is not supported because of high instream turbidity (6.7 miles). NOT ASSESSED. The lower 10.7 miles of this segment is not assessed.

RECOMMENDATIONS: HOUSATONIC RIVER (SEGMENT MA21-19)

- Because of the frequency of the reduced survival of *P. promelas* in the Housatonic River downstream from the Lee WWTP discharge, additional instream studies (ambient chronic toxicity testing) should be conducted. If significant chronic toxicity is detected, determine cause(s) and source(s) of instream toxicity (e.g., evaluate the mixing zone of the Lee WWTP effluent and its potential to hug the bank, effects of other upstream discharges).

RECOMMENDATIONS - Continued: HOUSATONIC RIVER (Segment MA21-19)

- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and pages IV-47-49) should be reviewed to help design future monitoring plans for the Housatonic River subwatershed.
- EPA is in the process of collecting additional data on river sediments and bank soils from Dalton through Sheffield, although this data has not yet become available (expected sometime in 2000). EPA has also been collecting considerable data (sampling in 1998 and 1999) on river biota at a variety of trophic levels (including fish, frogs, and ducks) as part of their Ecological Risk Assessment. Additional data may also be collected in 2000.
- Evaluate the possible erosional impacts downstream of the Glendale Project as a result of stream fluctuations. Determine whether streambank stabilization techniques (via S.319 funding) would be effective.

Lenox WWTP

- The NPDES permit needs to be reissued given that the facility was recently upgraded to accept the flow from the Lenoxdale WWTP. Need to determine the instream waste concentration of the new discharge at 7Q10 and establish permit limits (i.e., whole effluent toxicity testing, total residual chlorine, etc.).

Schweitzer-Mauduit International, Inc.

- The water balance provided in the Schweitzer-Mauduit International, Inc. NPDES permit application needs to be reviewed and updated (1994 vs. 1999 changes) as necessary based on the potential increase in production at the facility.
- Approximately 30% of the water withdrawn from Laurel Lake appears to be discharged as overflow water via outfalls #006 and 007. Attempts should be made to minimize the excess withdrawal and subsequent discharges.
- Effluent turbidity and/or total suspended solids in the process wastewater discharge has been documented as being a substantial problem. DEP DWM strongly recommends that this problem be eliminated to improve both the aesthetic quality in the Housatonic River as well as reduce the impacts of this discharge on the benthic macroinvertebrate community. Although some chronic toxicity has been present in the effluent, DEP DWM also recommends that the solids issue should be addressed prior to toxicity issues.
- Depending on location of effluent discharges, consider testing outfall 002 and 003 individually for toxicity. If the outfalls are "combined" prior to the actual discharge, the Schweitzer-Mauduit International, Inc. NPDES permit requirements for whole effluent toxicity testing should be reduced to one organism, *C. dubia*, which has been the more sensitive test organism. The analysis of several effluent variables can also be eliminated in the toxicity testing requirements: Ag, Cd, Cr, Fe, Ni, Cn, and phenols.
- Since the 1997 instream impact evaluation has shown moderate impacts to the benthos of the Housatonic River downstream from the Schweitzer-Mauduit International, Inc. wastewater treatment plant discharges, consideration should be given to following: imposing a concentration based TSS limit in the permit, requiring a TIE/TRE, and requiring an instream impact evaluation which would also evaluate the zone of impact.

Lee WWTP

- The Lee WWTP NPDES permit requirements for whole effluent toxicity testing should be reduced to one organism, *P. promelas*, which has been the more sensitive test organism. The analysis of several effluent variables can also be eliminated in the toxicity testing requirements: Al, Cd, Cr, Ni, and Pb. Lead can also be eliminated from the dilution water monitoring requirement.
- Depending on any increases in capacity at the Lee WWTP facility, readjust permit limits as necessary.

RECOMMENDATIONS - Continued: HOUSATONIC RIVER (Segment MA21-19)

Southdown Corporation

- Southdown Corporation (formerly a Lee Lime Corporation), on Marble Street in Lee, has an NPDES permit to discharge to an unnamed swamp presumably in the Willow Brook subwatershed. The original permit expired in 1984 and has been administratively continued.
- A site visit should be conducted at this facility to determine if the individual NPDES permit needs to be reissued or if the facility should apply for coverage under a general permit(s).

Mead Specialty Papers Laurel and Willow Mills

- Continue to monitor the effluents for acute and chronic toxicity to evaluate the effectiveness of the wastewater treatment plant upgrades. Mead has some acute toxicity that has been associated with one of their production lines. This occurs only periodically 3 days every six weeks (clutch paper production), but acute toxicity has been associated with this waste-stream.
- Mead has applied to DEP DWM for a WMA permit for two new wells, which have not yet been drilled.
- Instream temperatures may be elevated in the reach of Housatonic River between Schweitzer Mill operations and downstream to Mead Willow Mill discharge (see note for Mead Corporation Specialty Paper Division). Need to carefully review the thermal discharges and whether or not the permit limits protect the Class B standards. Consider requiring in-situ temperature monitoring.
- Evaluate whether or not there are any instream impacts associated with the Mead Specialty Paper Division water withdrawals from East and West brooks (tributaries to Beartown Brook). None of these three streams are currently included in the WBS database and are therefore unassessed (Dallaire 1999).

Stockbridge WWTP

- Update and reissue NPDES permit with appropriate requirements and limits (toxicity testing, sludge, industrial pretreatment, and potentially flow equalization). Evaluate and/or incorporate recommendations from the Comprehensive Wastewater Plan (SRF Project) in Stockbridge as approved by the agencies.

Glendale Project FERC P-2801

- Operator induced streamflow fluctuations have not yet been corrected at the Glendale Project and it is imperative that these fluctuations do not continue during the summer of 2000 (Springer 2000).
- A plan to eliminate occurrences of operator-induced streamflow fluctuations in the Housatonic River must be submitted to FERC by June 2000 (Springer 2000). Continue to monitor the effectiveness of compliance with "run-of-river" operations.
- Monthly reports of operational records for May through October 2000 and the date in 1999 when the minimum flow release was changed to the dam crest must be submitted to FERC (Springer 2000).
- Establish the August median flow for this segment of the Housatonic River as well as the aquatic base flow (ABF) in consultation with DEP and DFWELE/DFW. Amend the Glendale license as appropriate to maintain an adequate minimum flow in the bypass reach.

Lane Construction Corporation in Lee

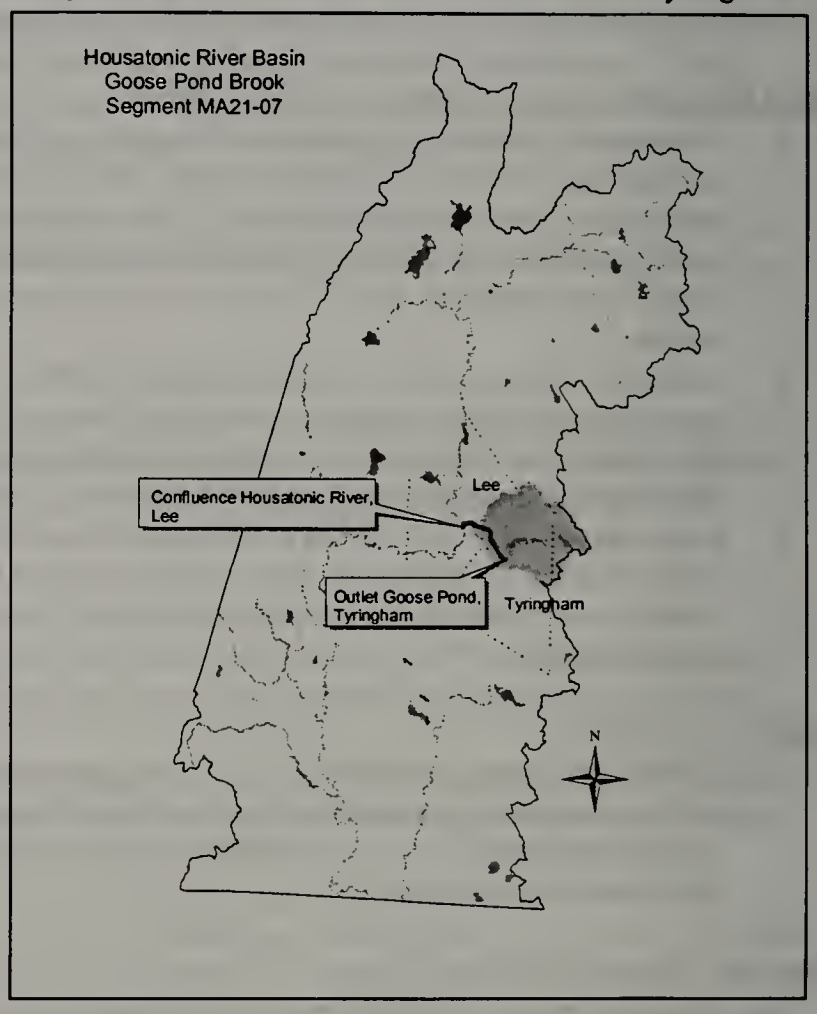
- According to the *Berkshire Regional Planning Commission Nonpoint Source Assessment Report* (1999), this facility currently has no sediment controls and there is evidence of erosion problems and sediment deposition into the Housatonic River. This facility is listed as having a general stormwater permit (MAR05A536). A site visit should be conducted to evaluate the facility's pollution prevention plan and to assess compliance with this plan. Erosion control and best management practices to control stormwater runoff from this operation must be implemented.

GOOSE POND BROOK (SEGMENT MA21-07)

Location: Outlet of Goose Pond, Tyringham to confluence with Housatonic River, Lee.
Segment Length: 2.3 miles. Classification: Class B, Cold Water Fishery.

SEGMENT DESCRIPTION

Goose Pond Brook, a Class B Cold Water Fishery, originates at the outlet of Goose Pond in Tyringham. The brook initially flows southwest but quickly turns and flows in a northwesterly direction, into Lee and passes by the abandoned building(s) of the Westfield River Paper Company. The brook continues down a steep gradient and then turns and heads in a more westerly direction. Goose Pond Brook is joined by Greenwater Brook (which drains a large portion of the subwatershed along Routes 20 and I-90), continues adjacent to Route 20, and flows through an industrialized area prior to discharging into the Housatonic River just downstream of the Route 102 bridge in Lee.



The majority of the watershed area is forested with the exception of the pond's shoreline with residential development. A major construction project, an outlet mall, was recently built on a hillside adjacent to Goose Pond Brook visible from the Mass Pike Interchange at Lee near to its confluence with the mainstem Housatonic River.

Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	86%
Residential	4%
Wetlands	2%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	78%
Residential	11%
Industrial	6%

WITHDRAWALS AND DISCHARGES

NPDES:

1. MA0001031 – The Westfield River Paper Company, Inc. on Forest Street in Lee ceased its operation. The NPDES permit was terminated on 11 October 1994 and there are no longer any non-contact cooling water or treated process wastewater discharges to Goose Pond Brook. The hydroelectric plant is no longer in use.

USE ASSESSMENT

No sampling has been conducted, therefore all uses for Goose Pond Brook (Segment MA21-07) are currently not assessed. However, the problems associated with the construction of the Outlet Village Mall on the hillside adjacent to Goose Pond Brook were eliminated once the construction was completed.

- Fish Consumption Advisory – There is currently no specific fish consumption advisory for this river. The DPH fish consumption advisory in effect for the mainstem Housatonic River

includes a provision that recommends that fish taken from feeder streams to the Housatonic River be trimmed of fatty tissue prior to cooking (MA DPH 1999). The intention of this provision is to minimize the potential risk associated with fish that may migrate in or out of the mainstem Housatonic River.

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				

RECOMMENDATIONS: GOOSE POND BROOK (SEGMENT MA21-07)

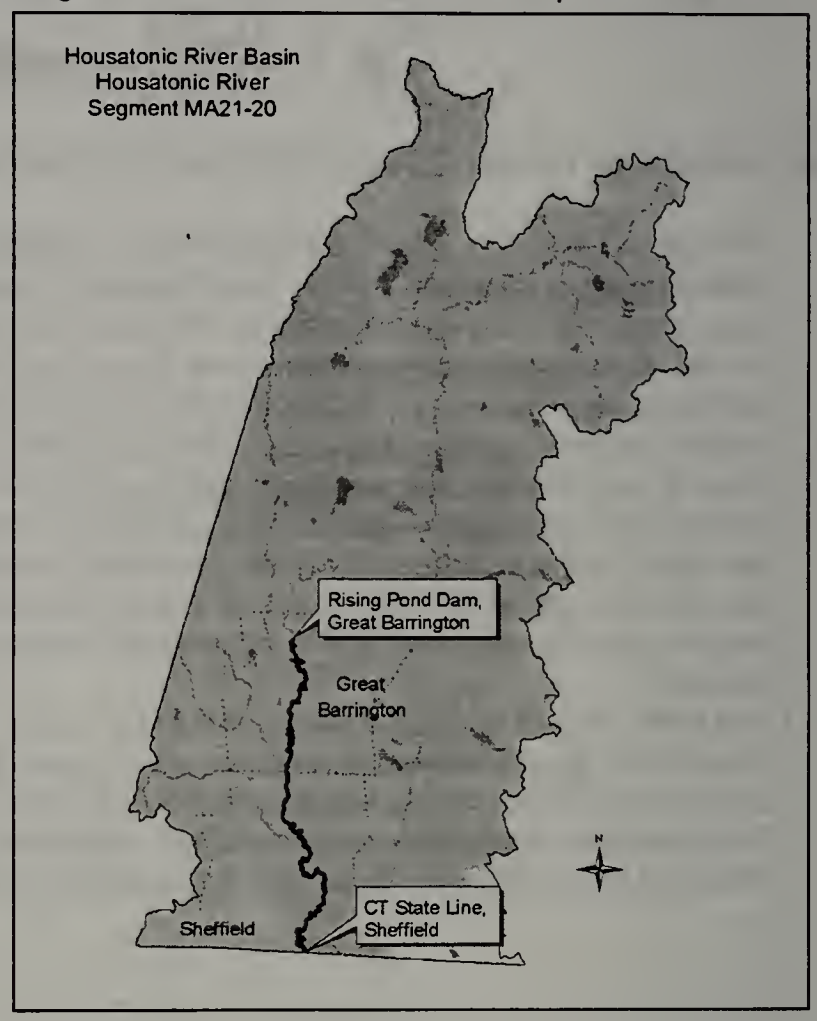
- The current status of Westfield River Paper Company landfill in the Goose Pond Brook watershed is unclear and may warrant further investigation to determine possible impacts on the brook.
- According to the Berkshire Regional Planning Commission Nonpoint Source Pollution Assessment Report, erosion rills are evident around the parking lots at the Outlet Village on Route 20 and additional stormwater runoff controls may be necessary (1999).
- Conduct regular maintenance inspections of BMPs to control stormwater runoff at the outlet mall.
- Despite the DPH recommendation that fishes taken from tributaries to the Housatonic River should be trimmed of fatty tissue before cooking (MA DPH 1999), body burdens of PCB in the edible portion of fish from Goose Pond Brook should be further investigated. Determination of natural or man-made barriers to migration in the tributaries of the Housatonic River, including Goose Pond Brook, would assist in the identification of stream reaches where the potential for PCB contaminated fishes is greatest.
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and page IV-48) should be reviewed to help design future monitoring plans for this segment of the Housatonic River.

HOUSATONIC RIVER (SEGMENT MA21-20)

Location: Outlet of Risingdale Impoundment, Great Barrington to the state line Sheffield, MA/Canaan, CT. Segment Length: 22.5 miles. Classification: Class B, Warm Water Fishery.

SEGMENT DESCRIPTION

From the outlet of the Rising Pond Dam in Great Barrington, the Housatonic River flows past the Fox River Paper Company, Rising Paper Division, and continues to meander in a southerly direction. Streamflow has been monitored by USGS since 1913 at their gage (01197500) at upstream of Division Street in the village of Van Deusenville. Approximately 0.5 miles downstream of the gage, the Housatonic River receives the flow of the Williams River, one of its largest tributaries. The second major tributary in this segment, the Green River, enters the Housatonic River after it has made its way through the Great Barrington business district, past the Great Barrington wastewater treatment plant and then the Great Barrington Fairgrounds located on its western shore. The Housatonic River continues to meander through the flat, broad flood plain and enters the town of Sheffield. Approaching Sheffield Plain, the river meanders begin to increase and many backwater pools are created during periods of high flows. Dairy and agricultural farming in this area is common. The Housatonic River receives the flow of two additional major tributaries in Sheffield, Hubbard Brook near Sheffield center and the Konkapot River, just before it leaves the state of Massachusetts and enters Canaan, Connecticut.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	69%
Agriculture	12%
Residential	7%

Land-use estimates in the 100' riparian zone from the streambanks:

Agriculture	32%
Forest	18%
Open Land	5%

WITHDRAWALS AND DISCHARGES

WMA:

1. Registration #10211303 for Fox River Paper Co.-Rising Paper Division authorizes a system-wide withdrawal of 1.04 MGD from two wells (Park Street Well and Park Street Well 2).

NPDES:

1. MAG250821 – issued December 1994 to the Fox River Paper Company, Rising Paper Division for their discharge via outfall #001of 0.133 MGD average monthly flow of non-contact cooling water to the Housatonic River. (This discharge was formerly permit # MA0035157 which is now closed.) The 7Q10 of the Housatonic River at the Great Barrington gage is 69 cfs (USGS 1998). The process wastewater is discharged (without pretreatment) to the Great Barrington WWTP.
2. MA0101524 – issued September 1990 to the Great Barrington WWTP authorizing an average monthly discharge of 3.2 MGD of treated wastewater (domestic and industrial) via outfall # 001 to the Housatonic River. The facility is a secondary wastewater treatment plant that uses chlorine for disinfection. The facility has an acute toxicity limit of LC50 > 100% effluent and a chronic monitor only requirement.

Stormwater:

1. MAR05A587 – The Fox River Paper Company, Rising Paper Division in Great Barrington (Berkshire Regional Planning Commission 1999).

USE ASSESSMENT

A RBP III upstream/downstream evaluation (21-HR05 and 21-HR06) of the Great Barrington WWTP discharge was conducted by DEP DWM biologists in the late August 1997 (Appendix D).

The USGS conducted a suspended sediment study in the Housatonic River near Great Barrington and in the village of Ashley Falls, Sheffield between April 1994 and March 1996. These data are reported in Bent (1999b), Socolow *et al.* (1996) and Socolow *et al.* (1997).

To comply with their NPDES permit, the Great Barrington WWTP conducts whole effluent toxicity testing on two test organisms (*C. dubia* or *P. promelas)*. Additionally the facility collects water from the Housatonic River at the Bridge Street bridge upstream of their effiuent discharge for use as dilution in toxicity tests. Ambient and whole effluent toxicity testing data from the WWTP were reviewed (Dallaire 2000).

Blasland, Bouck, and Lee, Inc. (1999) collected young-of-the-year fish samples for PCB analysis in 1994 and 1998 from one station in this segment of the Housatonic River; station HR6 near the MA/CT state line. EPA is in the process of collecting additional PCB data on river sediments and bank soils from Dalton through Sheffield, although this data has not yet become available (expected sometime in 2000). EPA has also been collecting considerable PCB data (sampling in 1998 and 1999) on river biota at a variety of trophic levels (including fish, frogs, and ducks) as part of their Ecological Risk Assessment. Additional data may also be collected in 2000.

The USGS NAWQA study sampled one station in this segment of the Housatonic River in Great Barrington upstream of the Great Barrington WWTP (Harris 1997 and Coles 1998).

Effects of the Glendale Project on streamflow conditions were recorded in the instantaneous streamflow conditions from the USGS gage in Great Barrington (01197500). The stream fluctuations were investigated as a result of citizen complaints (Prendergast 1999).

- Bioassessment/Habitat - Although DEP DWM noted moderate impacts to the benthic macroinvertebrate community in the upstream/downstream comparison, the response may have been attributable, in part, to habitat differences. While the riparian zone at the upstream (reference) station had a high degree of stabilization, the riverbanks directly upstream of the test station were vertical, completely denuded of vegetation and had a high likelihood of eroding during high water. Results and the discussion of the benthic macroinvertebrate analysis can be found in Appendix D.

- Water Quality - Fourteen percent of the suspended sediment samples collected by USGS primarily during storm events in the Housatonic River near the village of Ashley Falls exceeded 25 mg/L (106 of 738 days) (Bent 1999b, Socolow *et al.* (1996) and Socolow *et al.* (1997). These were noticeably higher than those documented upstream at Great Barrington (2%). These

exceedences, several of which were prolonged, are of concern since they are most likely the result of a combination of increased agricultural activities and natural conditions (geology and geomorpholoy).

- Water Quantity - Streamflow measurements (instantaneous) at the USGS gage on the Housatonic River in Great Barrington appear to be reflective of the hydromodification practices at the Glendale Project hydropower facility (rapid streamflow fluctuations). The *Aquatic Life Use* is considered threatened due to hydromodification based on these observations in the upper 1.5 mile reach (from the outlet of Risingdale Impoundment to the Housatonic's confluence with the Williams River).

- Ambient Toxicity - The Great Barrington WWTP collects water from the Housatonic River at the Bridge Street bridge upstream of their effluent discharge. These river samples are used as dilution water for their effluent toxicity tests. Survival of the cladaceron, *Ceriodaphnia dubia,* test organisms exposed to Housatonic River water (7-day) has been ≥90% in the 24 tests conducted between March 1993 and 1999 (Dallaire 2000). Fathead minnow (*Pimephales promelas)*, test organism survival has been ≥83%. Dilution water physical/chemical data from this location were as follows: pH ranged from 7.0 to 8.4 SU, alkalinity between 76 and 166 mg/L, hardness between 88 and 216 mg/L. Ammonia-nitrogen concentrations were low ranging between <0.07 and 0.55 mg/L. Total suspended solids were generally low although one of the 24 measurements exceeded 25 mg/L (47 mg/L). Conductivity ranged from 253 to 717 µmho/cm.

- Effluent Toxicity Testing - Effluent toxicity testing of the Great Barrington WWTP effluent has not documented any acute whole effluent toxicity to either *C. dubia* or *P. promelas*. Four of the 24 test events, however, indicated levels of chronic toxicity ranging between <6.25 to 50% effluent to *C. dubia* which appears to be the more sensitive organism (Dallaire 2000).

- Tissue Chemistry - Blasland, Bouck, & Lee, Inc. (1999) – The concentration of PCB in young-of-the-year fish collected at HR6 ranged between 1,000 and 4,500 µg/kg wet weight (PPB) in largemouth bass, yellow perch, and bluegill. All of these data exceed (2 to 9 times) the NAS/NAE guideline for total PCB (in Coles 1998) of 500µg/kg wet weight for the protection of fish-eating wildlife.

- Sediment Chemistry - The USGS NAWQA study sampled Housatonic River streambed sediment in Great Barrington upstream of the Great Barrington WWTP. The PCB concentration was 660 µg/kg dry weight (Harris 1997) which was 65 times higher (adjusting for organic carbon content) than the S-EL guideline (Persaud *et al.* 1993). This sediment sample was comprised primarily of sand (85%) and silt (14%). Iron and manganese both exceeded (slightly) the S-EL guidelines. Several trace metals (As, Cd, Cr, Cu, Pb, Hg, Ni, and Zn) exceeded the L-EL guideline.

The *Aquatic Life Use* for the entire 22.5 mile length of this segment is evaluated as non-support because of elevated levels of PCB in fish tissue and sediment. Hydromodification (abnormal streamflow fluctuation) is considered a threat to aquatic life in the upper 1.5 mile reach of this segment due to the Glendale Project.

- Fecal Coliform Bacteria - Fecal coliform bacteria data reported by USGS for the Housatonic River at Ashley Falls ranged between 55 and 760 cfu/100ml between November 1995 and September 1996 (Socolow *et al.* 1997). Four samples were collected during the primary contact recreation season, however the dataset is too limited to assess either of the recreational uses since this segment of the Housatonic River and many of its tributaries have such a high percentage of agriculture.

- Fish Consumption Advisory – The state issued a fish consumption advisory for the Housatonic River in 1982. The advisory recommended that the general public should not consume fish, frogs and turtles from the Housatonic River between Dalton and Sheffield because of PCB contamination. In 1995, DPH updated their advisory to include a recommendation that fish taken from feeder streams to the Housatonic River should be trimmed of fatty tissue prior to cooking

(MA DPH 1999). Because of this advisory, the *Fish Consumption Use* is not supported for this segment of the Housatonic River.

- Aesthetics - The aesthetic quality of the Housatonic River downstream of the Great Barrington WWTP discharge was compromised by the highly colored (red) effluent noted during DEP DWM sampling (Appendix D). The plume was visible (mid-channel) for approximately 0.4 miles downstream. With the exception of the 0.4 miles downstream of the Great Barrington WWTP discharge, the *Aesthetic Use* of this segment of the Housatonic River is evaluated as support.

Designated Use		Status: Housatonic River (Segment MA21-20
Aquatic Life		NON-SUPPORT. The entire 22.5 mile length of this segment is evaluated as non-support because of elevated levels of PCB in tissue and sediment. Hydromodification threatens the *Aquatic Life Use* downstream of the Glendale Project.
Fish Consumption		NON-SUPPORT. The entire 22.5 mile length of this segment does not support this use because of elevated levels of PCB in frogs, fish and turtles resulting from the GE Company Pittsfield plant.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		SUPPORT. This use is evaluated as support for 22.1 miles. NON-SUPPORT. The colored discharge from the Great Barrington WWTP impairs 0.4 miles of this segment.

RECOMMENDATIONS: HOUSATONIC RIVER (SEGMENT MA21-20)

- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and page IV-47-49) should be reviewed to help design future monitoring plans for this segment of the Housatonic River.
- EPA is in the process of collecting additional data on streambed sediments and river bank soils from Dalton through Sheffield, although this data has not yet become available (expected sometime in 2000). EPA has also been collecting considerable data (sampling in 1998 and 1999) on river biota at a variety of trophic levels (including fish, frogs, and ducks) as part of their Ecological Risk Assessment. Additional data may also be collected in 2000.
- Determine whether or not the elevated levels of suspended sediment in the lower Housatonic River are the result of naturally occurring conditions and/or a result of land-use practices (agricultural –either cropland or pasture land).
- The Massachusetts Department of Food and Agriculture and the U.S. Department of Agriculture's Natural Resource Conservation Service should conduct outreach to farmers regarding the need for streambank stabilization and best management practices in the riparian zone.
- Conduct additional monitoring (increase spatial and temporal coverage) of fecal coliform bacteria to assess the status of *Primary* and *Secondary Contact Recreational* uses.
- Monitor the effectiveness of operation changes at the Glendale Project to monitor and reduce aberrant streamflow fluctuations in this segment of the Housatonic River.
- Evaluate the possible erosional impacts downstream of the Glendale Project as a result of stream fluctuations. Determine whether streambank stabilization techniques (via S.319 funding) would be effective.

RECOMMENDATIONS - Continued: HOUSATONIC RIVER (Segment MA21-20)

- The sediment sample collected by USGS as part of the NAWQA study (upstream of the Great Barrington WWTP) had the second highest concentration of Hg in the Connecticut, Housatonic, and Thames River Basins study unit. The need for additional monitoring of Hg contamination in both sediment and tissue merits further investigation.

Great Barrington WWTP:

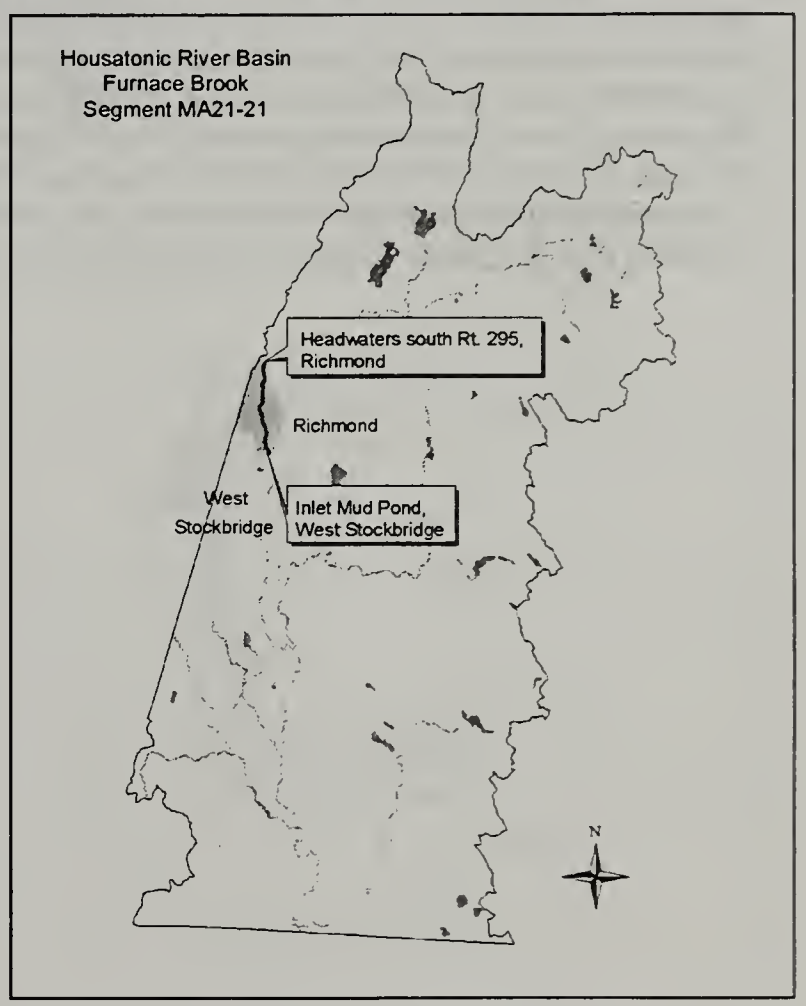
- The Great Barrington WWTP NPDES permit requirements for whole effluent toxicity testing should be reduced to one organism, *C. dubia*, which has been the more sensitive test organism. The analysis of several effluent variables can also be eliminated in the toxicity testing requirements: Ag, Cd, Cr, Fe, and Ni.
- The Great Barrington WWTP NPDES permit should contain a color limit to protect the aesthetic quality of the Housatonic River. The Great Barrington WWTP receives a substantial portion of its wastewater from the Fox River Paper Co.-Rising Paper Division that apparently was not pre-treating their wastewater. Their NPDES permit (issued 1990) required the implementation of an industrial pretreatment program. DEP has issued a consent order to resolve the color pass through problem (Prendergast 1999). The WWTP is presently evaluating a new (DEP approved) process of adding chlorine as an oxidant to the wastewater influent to resolve the color problem.

FURNACE BROOK (SEGMENT MA21-21)

Location: Headwaters south of Route 295 (Canaan Road), Richmond to inlet of Mud Ponds, West Stockbridge. Segment Length: 3.7 miles. Classification: Class B.

SEGMENT DESCRIPTION

Furnace Brook, a Class B waterbody, originates just south of Canaan Road in Richmond and flows south to the inlet of Mud Ponds in West Stockbridge. An orchard is present in the upper watershed and the brook flows under the Conrail Railroad in the community of Richmond Furnace.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	75%
Agriculture	16%
Residential	5%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	81%
Agriculture and Wetlands	7%
Residential	3%

WITHDRAWALS AND DISCHARGES

None known.

USE ASSESSMENT

DEP DWM conducted benthic macroinvertebrate sampling on 27 August 1997 in Furnace Brook (station FB01) just downstream of Furnace Road in Richmond (approximately 0.4 miles upstream of the inlet to Mud Ponds).

- Bioassessment/Habitat – The benthic community was found to be slightly impaired compared to the Konkapot River regional reference station (Appendix C). The slight impairment of the benthic community was thought to be the result of naturally reduced base-flows. The benthic community in Furnace Brook showed particularly high diversity including several pollution sensitive taxa and therefore the segment is assessed as fully supporting the *Aquatic Life Use*.

Designated Use		Status: Furnace Brook (Segment MA21-21)
Aquatic Life		SUPPORT. The entire 3.7 mile length of this segment is evaluated as supporting this use.
Fish Consumption		NOT ASSESSED.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		NOT ASSESSED.

RECOMMENDATIONS: FURNACE BROOK (SEGMENT MA21-21)

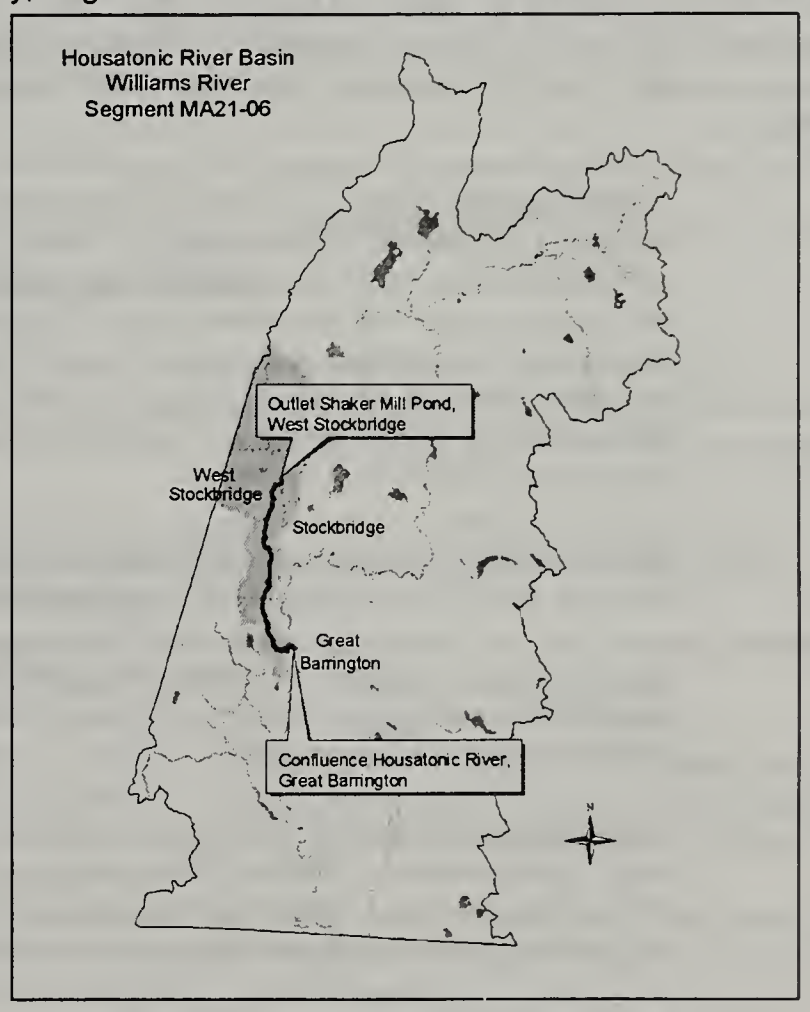
- An investigation into the presence/extent of damming structures in the impoundments of this watershed (especially the unnamed impoundment immediately upstream of the benthic macroinvertebrate sampling station) is recommended (Appendix C). Additional water quantity information, should be collected to better assess the relationship between biological integrity and streamflow.
- Disturbances observed in the riparian zone (clearing of vegetation and trash deposits) can be prevented by blocking off the dirt road that leads from Furnace Road to the stream.
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and page IV-50-51) should be reviewed to help design future monitoring plans for the Williams River subwatershed.

WILLIAMS RIVER (SEGMENT MA21-06)

Location: Outlet of Shaker Mill Pond, West Stockbridge to confluence with Housatonic River, Great Barrington. Segment Length: 10.0 miles. Classification: Class B, Cold Water Fishery.

SEGMENT DESCRIPTION

The Williams River, a Class B Cold Water Fishery, originates at the outlet of Shaker Mill Pond in West Stockbridge. The river flows south and receives the flow from the West Stockbridge WWTP then close to a large quarry in the upper reach of this segment. The river continues to flow in a southerly direction throughout most of its length. There is a small dam in the Williams River located just downstream of the West Stockbridge/Great Barrington town line at the Old Maids Swimming Hole. The river continues in a southerly direction until it turns east in the village of Van Deusenville and meanders towards its confluence with the Housatonic River in Great Barrington.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	67%
Agriculture	17%
Residential	7%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	58%
Wetlands	24%
Residential	9%

WITHDRAWALS AND DISCHARGES

WMA:

There are no WMA registered or permitted withdrawals in this river. There are, however, smaller public water suppliers (withdrawals less than 100,000 GPD) listed below:

1. PWS#1326000- West Stockbridge Water Department – Average use for 1998 was 0.045 MGD. Two groundwater sources. The original surface water supplies are no longer in use.
2. PWS#1326001 – Mill Pond Trailer Park – Average use for 1996 was 0.0069 MGD for the one approved well.
3. There are two additional wells in this segment that are not permitted since their withdrawals are <100,000 GPD.

NPDES:

1. MA0103110 – The West Stockbridge WWTP is authorized to discharge 0.076 MGD average monthly flow of treated sanitary wastewater via outfall # 001 to the Williams River although their actual average monthly flows are much less. The annual monthly average flow of the facility in 1999 was 0.011 MGD. The facility is an advanced wastewater treatment plant that uses UV for disinfection. The facility has an acute toxicity limit of $LC_{50} \geq 100\%$ effluent. The permit was issued in December 1990.

USE ASSESSMENT

The West Stockbridge WWTP collects water from the Williams River at the old train bridge located approximately 30' upstream of their effluent discharge. These river samples are used as dilution water for

their effluent toxicity tests. Whole effluent toxicity testing data from the West Stockbridge WWTP (required by their NPDES permit) from January 1993 and 1999 was also reviewed (Dallaire 2000). DEP DWM conducted Benthic macroinvertebrate sampling in August 1997 in the Williams River (station WR01) between Route 41 and Division Street bridge in Great Barrington. The USGS sampled the Williams River at the railroad bridge (200' south of Division Street) in Great Barrington as part of their suspended sediment study. Suspended sediment concentrations (mg/L), specific conductivity, and temperature, as well as instantaneous discharge were periodically measured between March 1994 and April 1996 (Socolow *et al.* 1996 and Socolow *et al.* 1997). Blasland, Bouck & Lee, Inc. collected fish from the Williams River off of Division Street in the village of Van Deusenville in September 1995 for PCB analysis as part of the GE Pittsfield Corporation MCP Supplemental Phase II/RCRA Facility Investigation (1996).

- Ambient toxicity testing - Survival of the cladaceron, *Ceriodaphnia dubia,* test organisms exposed to Housatonic River water (48-hours) has been ≥95% in the 20 tests conducted between January 1993 and 1999 (Dallaire 2000). Fathead minnow (*Pimephales promelas)*, test organism survival has been ≥95%. Dilution water physical/chemical data from this location were as follows: pH ranged from 7.2 to 8.1 SU, alkalinity between 60 and 165 mg/L, hardness between 48 and 178 mg/L. Ammonia-nitrogen concentrations were low ranging between <0.05 and 0.16 mg/L. Total suspended solids were not detected. Conductivity ranged from 237 to 518 µmho/cm.

- Effluent toxicity testing – No acute whole effluent toxicity to either *C. dubia* or *P. promelas* from the West Stockbridge WWTP effluent has been detected (Dallaire 2000).

- Bioassessment/Habitat – Results of the DEP DWM benthic macroinvertebrate analysis indicated no impairment to the benthic community compared to the Konkapot River (regional reference station) (Appendix C).

- Water quality – The daily mean suspended sediment concentration ranged from 1 to 151 mg/L (Socolow *et al.* 1996 and Socolow *et al.* 1997). Instream temperatures exceeded 20°C on 7 of 18 days sampled during the summers of 1994 and 1995 (June through September). Conductivity measurements ranged between 236 and 430 µS/cm.

- Fish Tissue – In September 1995, fish (smallmouth bass and brown trout) were collected from the Williams River by Blasland, Bouck & Lee, Inc. (1996) and analyzed as scales off/skin on fillets. Total PCB concentrations ranged from 810 to 2,600 PPB wet weight.

Based on the results of the biological and ambient toxicity testing data, the entire length of the Williams River is assessed as supporting the *Aquatic Life Use*.

- Fish Consumption Advisory – There is currently no specific fish consumption advisory for this river. The DPH fish consumption advisory in effect for the mainstem Housatonic River includes a provision that recommends that fish taken from feeder streams to the Housatonic River be trimmed of fatty tissue prior to cooking (MA DPH 1999). The intention of this provision is to minimize the potential risk associated with fish that may migrate in or out of the mainstem Housatonic River.

Designated Use		Status: Williams River (Segment MA21-06)
Aquatic Life		SUPPORT. The entire 10.0 mile length of this segment is evaluated as full support for this use.
Fish Consumption		NOT ASSESSED.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		SUPPORT. The entire 10.0 mile length of this segment is evaluated as full support for this use.

RECOMMENDATIONS: WILLIAMS RIVER (SEGMENT MA21-06)

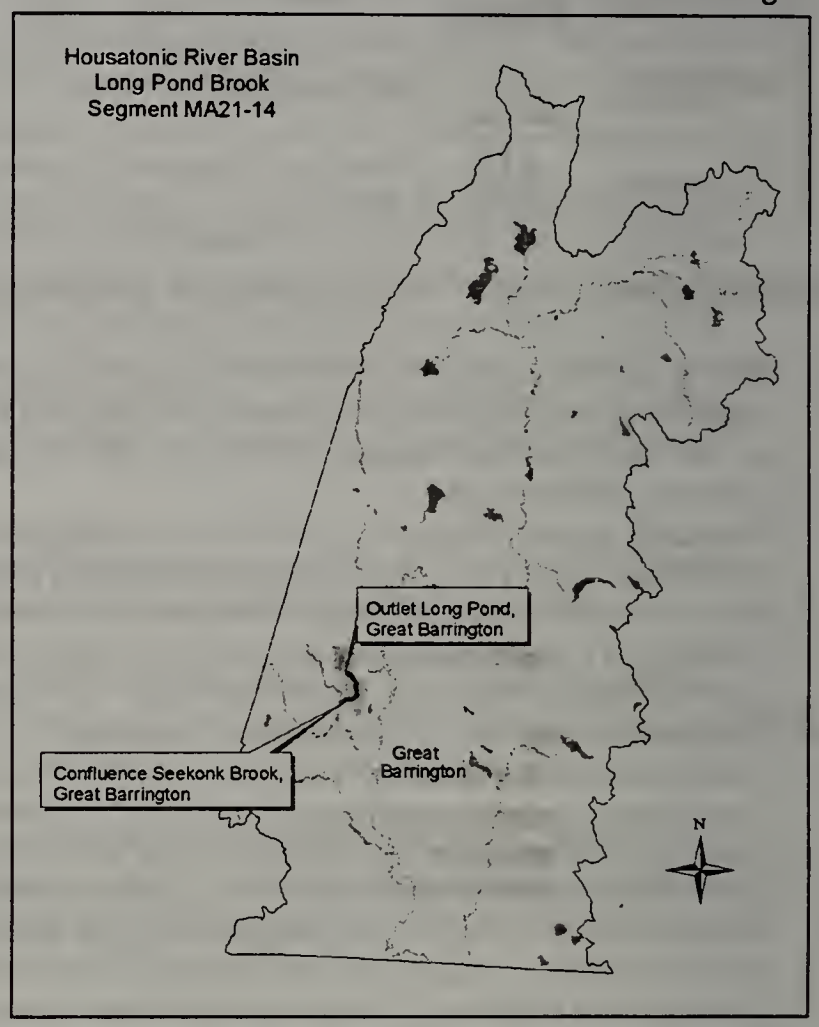
- The West Stockbridge WWTP NPDES permit requirements for whole effluent toxicity should be reduced to one organism, *C. dubia*. The analysis of several effluent variables can also be eliminated in the toxicity testing requirements Cd, Cr, Ni, Pb, and Zn, while Cu, Pb, and Zn in the ambient water can also be eliminated.
- Nonpoint source pollution in the form of isolated trash deposits were observed along both banks. Dumping of trash from adjacent road crossings should be strongly discouraged. Cleanup efforts should be conducted to eliminate existing trash deposits.
- Determine if there are any areas that may require BMPs to abate stormwater runoff impacts adjacent to the Williams River (e.g., Massachusetts Turnpike Crossing).
- Suspended sediment concentrations exceeded 25 mg/L in approximately 17% of the samples collected near the mouth of the Williams River by USGS, and the instream summer temperatures (particularly during August) exceeded 20°C. Determine if DFWELE has any concerns or information regarding the status of the Williams River in terms of supporting a cold water fishery and whether or not these conditions also exist in its upper subwatershed.
- Despite the DPH recommendation that fishes taken from tributaries to the Housatonic River should be trimmed of fatty tissue before cooking (MA DPH 1999), body burdens of PCB in the edible portion of fish from the Williams River should be further investigated. Determination of natural or man-made barriers to migration in the tributaries of the Housatonic River, including the Williams River, would assist in the identification of stream reaches where the potential for PCB contaminated fishes is greatest.
- Conduct a site visit to the limestone/marble quarry adjacent to the east bank of the Williams River west of Route 41 in West Stockbridge to identify whether or not there are any stormwater or other discharges from the operation to the Williams River. The quarry is owned and/or operated by Lane Construction. Rock is extracted in large chunks of limestone and/or marble bedrock and then is broken up into smaller gravel-sized bits rather than a traditional gravel pit that mines heterogeneous gravel deposits of glacial origin (Cohen 2000). Establish if an NPDES permit (individual or general stormwater) is necessary.
- Fecal coliform bacteria sampling should routinely be conducted (under both wet and dry sampling conditions) along the Williams River at popular swimming hole areas. These data should be reported to DEP DWM (used to evaluate the status of the *Primary* and *Secondary Contact Recreational* uses).
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and page IV-50-51) should be reviewed to help design future monitoring plans for the Williams River subwatershed.

LONG POND BROOK (SEGMENT MA21-14)

Location: Outlet of Long Pond, Great Barrington to confluence with Seekonk Brook, Great Barrington.
Segment Length: 1.8 miles. Classification: Class B.

SEGMENT DESCRIPTION

Long Pond Brook, a Class B waterbody, flows south southeast and bends to the west southwest through a small unnamed impoundment near Simons Rock Early College continuing to its confluence with Seekonk Brook in Great Barrington.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	70%
Agriculture	9%
Open Land	8%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	55%
Wetlands	21%
Open Land	13%

WITHDRAWALS AND DISCHARGES

WMA:

1. Housatonic Water Works Company in Great Barrington is registered (10211306) to withdraw 0.27 MGD of water from Long Pond. The Housatonic Water Works only supplies the village of Housatonic. In 1994, the average water use was 0.41 MGD, and in 1995 and 1998 it was 0.36 and 0.34 MGD respectively (Bent 1999a and Prendergast 1999).

USE ASSESSMENT

DEP DWM conducted a synoptic survey of Long Pond in August 1997. Construction activities were apparent during the 1997 field survey. According to DEP's Western Regional Office, construction activities included the upgrading of the treatment facility, installation of a chlorine contact facility, a new storage facility, and general renovations (Prendergast 1999). Since no minimum flow is maintained out of the reservoir, conditions are believed to be similar to those encountered in 1992 (Kennedy et al. 1993). At that time withdrawals out of Long Pond resulted in the elimination of a portion of Long Pond Brook (approximately 0.25 miles). The *Aquatic Life Use* is therefore evaluated as non-support.

Designated Use		Status: Long Pond Brook (Segment MA21-14)
Aquatic Life		NON-SUPPORT. The entire 1.8 mile length of this segment is evaluated as non-support because of flow alteration (A minimum flow is not maintained out of the reservoir).
Fish Consumption		NOT ASSESSED.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		NOT ASSESSED.

RECOMMENDATIONS: LONG POND BROOK (SEGMENT MA21-14)

- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and page IV-52-53) should be reviewed to help design future monitoring plans for the Green River subwatershed.

<u>Housatonic Water Works</u>

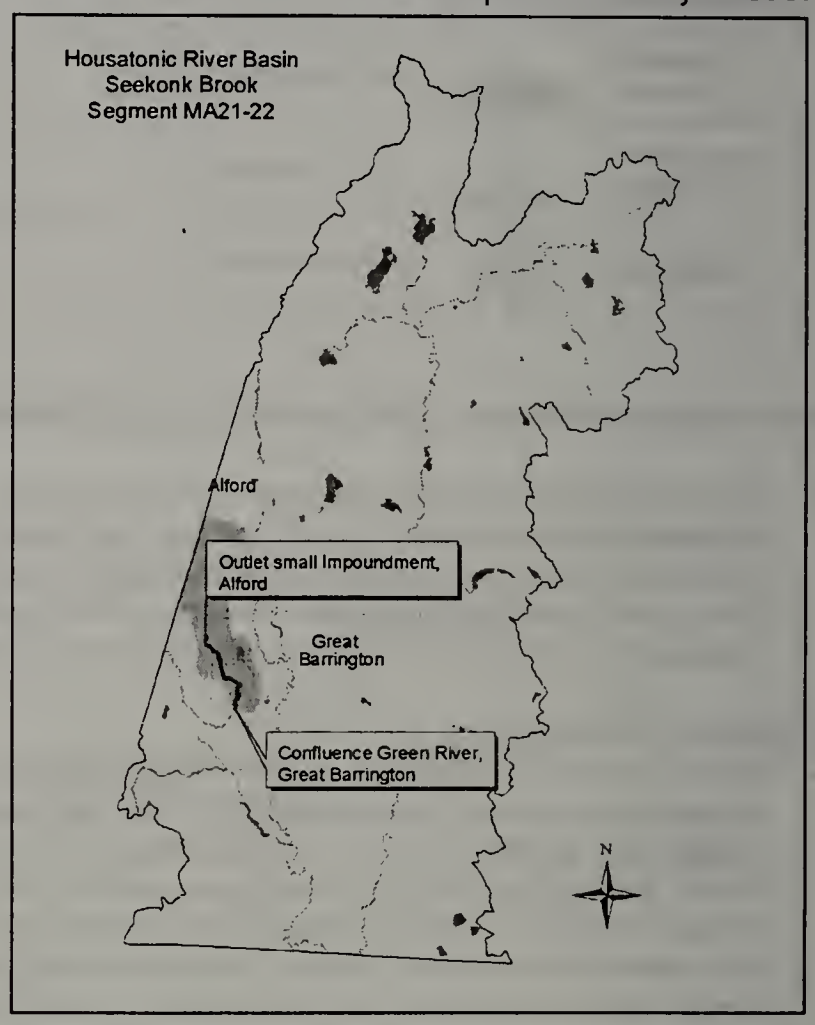
- Determine if the Housatonic Water Works Company in Great Barrington can comply with their WMA registration via water conservation or other mechanisms. If not possible, a WMA permit with appropriate conditions (e.g., maintenance of minimum streamflow) is warranted. The Housatonic Water Works Company in Great Barrington should implement water conservation/water supply system efficiency recommendations as described in the DEM report entitled *Water Resources of the Housatonic River Basin: Water Use and Hydrology* (MA DEM 1999).
- Water conservation measures should be maximized by the Housatonic Water Works, to minimize the frequency and duration of no flow events in Long Pond Brook.
- Collect additional data to document the frequency, duration and severity of low-flow conditions and occurrences of dewatered and/or occasionally dry streambed in Long Pond Brook below the outlet of Long Pond. Document this information via photographs and/or stream depth and velocity measurements.

SEEKONK BROOK (SEGMENT MA21-22)

Location: Outlet of small impoundment east of West Road, Alford to confluence with the Green River, Great Barrington Segment Length: 4.6 miles. Classification: Class B.

SEGMENT DESCRIPTION

Seekonk Brook, a Class B waterbody, originates at the outlet of a series of small impoundments just east of West Road in Alford. The brook flows in a southeasterly direction into Great Barrington, where the original channel continued southeast, received the flow from Long Pond Brook, and continued south to its confluence with the Green River in Great Barrington. The brook appears on the 1987 USGS topographical map to have been diverted to the west upstream of Seekonk Road. This diversion runs parallel to Seekonk Cross Road, through two small unnamed impoundments, joining the Green River just upstream of its original channel.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	67%
Agriculture	23%
Residential	4%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	41%
Wetlands	23%
Agriculture	20%

WITHDRAWALS AND DISCHARGES

WMA:
There are no WMA registered or permitted withdrawals in this brook's subwatershed. There is, however, a small non-community public water supplier (withdrawal less than 100,000 GPD).

USE ASSESSMENT

Too little data exists to evaluate the status of the designated uses, therefore all uses for Seekonk Brook (Segment MA21-22) are not assessed.

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

RECOMMENDATIONS: SEEKONK BROOK (SEGMENT MA21-22)

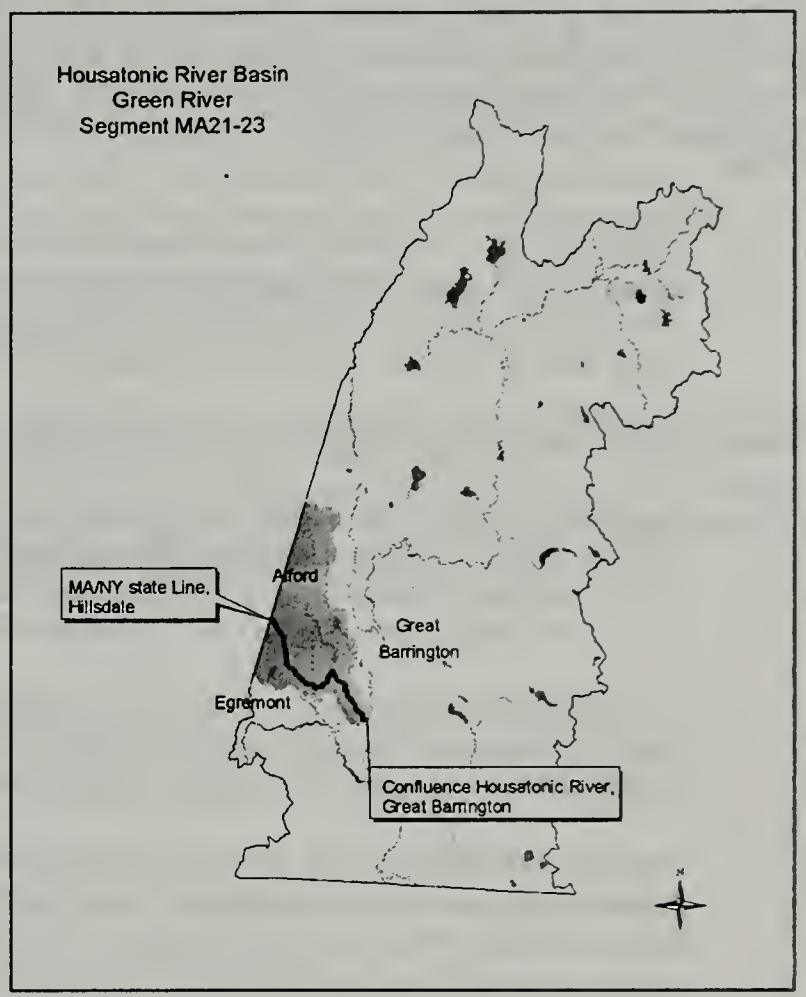
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and page IV-52-53) should be reviewed to help design future monitoring plans for the Green River subwatershed.

GREEN RIVER (SEGMENT MA21-23)

Location: Border of Hillsdale, New York and Alford, Massachusetts to confluence with the Housatonic River, Great Barrington. Segment Length: 9.8 miles. Classification: Class B, Cold Water Fishery.

SEGMENT DESCRIPTION

The Green River, a Class B Cold Water Fishery, flows south-southeast out of New York state through Alford, MA and into the northeast corner of Egremont. The river then turns northeast after passing by the Great Barrington Airport. It receives the flow from Seekonk Brook, turns southeast past the discontinued USGS gaging station (01198000 at Hurlburt Street) and meanders to its confluence with the Housatonic River in southern Great Barrington.



The Green River Bioengineering Demonstration Project (NPS 94-03), a hydrologic modification study, was funded through the s. 319 Nonpoint Source Competitive Grants program ($126,000). The three-year (1995-1998) project involved the design, implementation, demonstration and evaluation of soil bioengineering techniques to control local bank erosion and restore bank stability; establish and maintain a healthy riparian buffer zone; and improve fisheries habitat. This demonstration project was conducted on the Green River, in Great Barrington, adjacent to Strassler Farm (Cesan 1998). The results of the study indicate that the streambank stabilization efforts are partially successful; additional measures are required to further stabilize and repair the eroded streambanks.

Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	60%
Agriculture	29%
Residential	5%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	59%
Agriculture	28%
Open Land	5%

WITHDRAWALS AND DISCHARGES

WMA:

1. The Great Barrington Fire District is registered (#10211301) to withdraw 1.09 MGD from two sources in Great Barrington including the groundwater withdrawal from the Green River Infiltration Gallery in this subwatershed. The Gallery has been in use since at least 1970. The second source is from East Mountain Reservoir on the east side of the Housatonic River. The average water use by the Fire District in 1994 and 1995 was within their registration (1.05 and 0.94 MGD, respectively) (Bent 1999a). In 1998 their withdrawal was 1.145 MGD (Prendergast 1999). In 1993 the Great Barrington Fire District conducted a microparticulate analysis of the Infiltration Gallery water. This analysis indicated no direct connection between the potable water and the river (Prendergast 1999).

USE ASSESSMENT

The USGS sampled the Green River upstream of Hurlburt Street in Great Barrington (at their discontinued long-term gage #011980000) as part of their suspended sediment study. The USGS initiated their suspended sediment study sampling in March 1994 and continued to measure daily mean suspended sediment concentration (mg/L) and discharge through March 1996. This data is reported in Socolow *et al.* (1996) and Socolow *et al.* (1997). The USGS NAWQA study site on the Green River, which included both fish tissue and sediment sampling (including total PCB), was located near USGS's discontinued long-term gaging station in Great Barrington (Harris 1997 and Coles 1998). Blasland, Bouck & Lee, Inc. collected fish from the Green River near its confluence with the Housatonic River in September 1995 for PCB analysis as part of the GE Pittsfield Corporation MCP Supplemental Phase II/RCRA Facility Investigation (1996).

- Water Quality – The daily mean suspended sediment concentration measured by USGS exceeded 25 mg/L only 4% of the time related to storm events (Socolow *et al.* 1996 and Socolow *et al.* 1997). The August median flow at the discontinued long-term USGS gage on the Green River was 5.4 MGD. Ninety-nine percent of the time the flow of the river exceeded 2.1 MGD.

Based on these data the *Aesthetics Use* in the Green River is assessed as full support.

- Sediment Quality - No PCB (<50 µg/kg dry weight) was detected in USGS's sediment sample (Harris 1997). This sediment sample was comprised primarily of sand (85%), silt (13%) and clay (1%). Iron and manganese both exceeded the S-EL guidelines. Several trace metals (As, Cr, Cu, Pb, Ni and Zn) exceeded the L-EL guideline (Persaud *et al.* 1993).

- Fish Tissue – In September 1995, fish (rock bass and brown trout) were collected from the Green River by Blasland, Bouck & Lee, Inc. (1996) and analyzed as scales off/skin on fillets. Total PCB concentrations ranged from 160 to 21,000 PPB wet weight.

  The concentration of PCB in the whole fish composite sample (comprised of eight white suckers, *Catastomas commersoni*) collected from the Green River by USGS was 620 µg/kg wet weight (Coles 1998). This level of PCB slightly exceeded (1.24 times) the NAS/NAE guideline of 500 µg/kg wet weight for total PCB (in Coles 1998) for the protection of fish-eating wildlife.

- Fish Consumption Advisory – There is currently no specific fish consumption advisory for this river. The DPH fish consumption advisory in effect for the mainstem Housatonic River includes a provision that recommends that fish taken from feeder streams to the Housatonic River be trimmed of fatty tissue prior to cooking (MA DPH 1999). The intention of this provision is to minimize the potential risk associated with fish that may migrate in or out of the mainstem Housatonic River.

Designated Use		Status: Green River (Segment MA21-23)
Aquatic Life		NOT ASSESSED.
Fish Consumption		NOT ASSESSED.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		SUPPORT. The entire 9.8 mile length of this segment is evaluated as supporting this use.

RECOMMENDATIONS: GREEN RIVER (SEGMENT MA21-23)

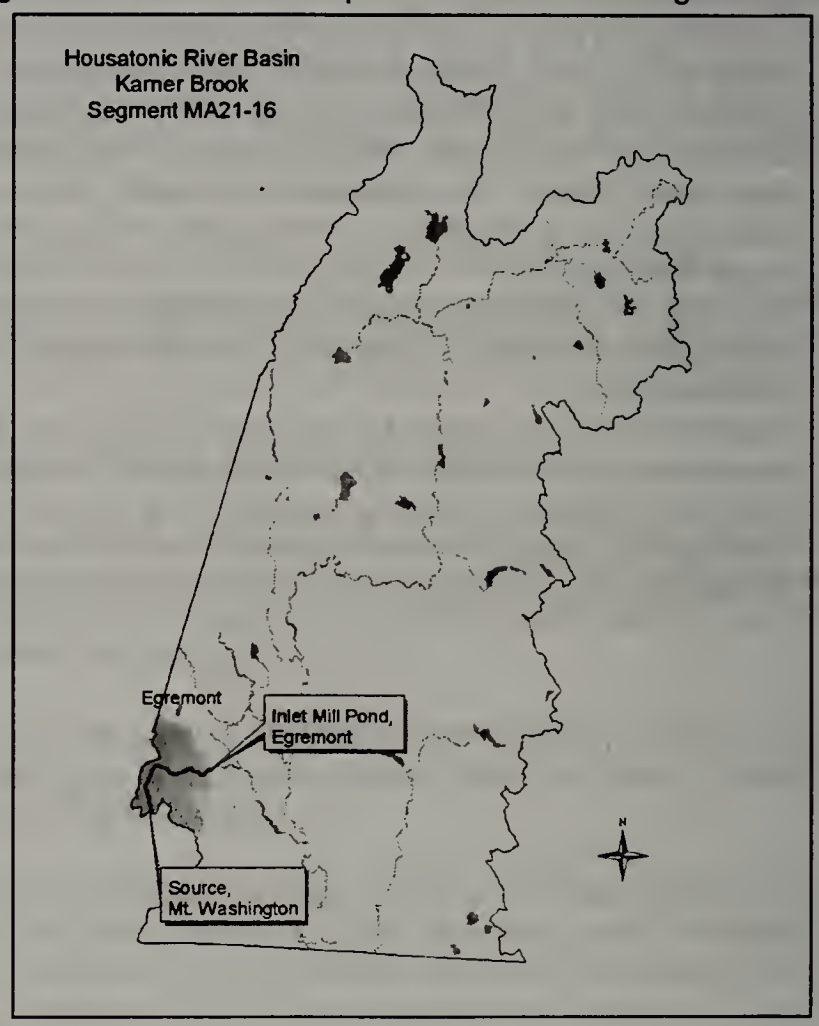
- Despite the DPH recommendation that fishes taken from tributaries to the Housatonic River should be trimmed of fatty tissue before cooking (MA DPH 1999), body burdens of PCB in the edible portion of fish from the Green River should be further investigated. Determination of natural or man-made barriers to migration in the tributaries of the Housatonic River, including the Green River, would assist in the identification of stream reaches where the potential for PCB contaminated fishes is greatest.
- Water quality monitoring has not historically been conducted in this river since it does not receive any direct discharges, and there is very little development in the drainage basin. Since a fairly high percentage of the land-use adjacent to the river is agricultural, monitoring of fecal coliform bacteria levels as well as DO, pH, and temperature, are recommended to assess the status of the *Primary* and *Secondary Contact Recreational* and *Aquatic Life* uses. This monitoring is also specifically recommended at the local swimming hole in the Green River located just downstream of Route 23 in Great Barrington.
- Because of the predominance of agricultural land-use practices adjacent to the Green River, further investigation is needed to identify potential nonpoint source pollution (e.g., riparian zone disturbances).
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and page IV-52-53) should be reviewed to help design future monitoring plans for the Green River subwatershed.

KARNER BROOK (SEGMENT MA21-16)

Location: Source, Mount Washington to the inlet of Mill Pond, South Egremont.
Segment Length: 4.2 miles. Classification: Class A, Public Water Supply.

SEGMENT DESCRIPTION

Karner Brook, a Class A public water supply, originates in the northern part of Mount Washington. The brook flows north into Egremont, paralleling the Mount Washington Road and then turns east. The South Egremont Water Company withdraws water from the brook upstream of a small dam upstream of Jug End Road. The brook continues to flow east, receiving the discharge from Fenton Brook and an unnamed tributary draining Marsh Pond and meanders to the inlet of Mill Pond in South Egremont. This stream is part of the Karner Brook ACEC.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	76%
Agriculture	10%
Residential	6%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	62%
Wetlands	15%
Residential	10%

WITHDRAWALS AND DISCHARGES

WMA:

1. The South Egremont Water Company (PWS #1090000-01S) withdraws water directly from Karner Brook. In 1994, the average water use was 0.11 MGD and in 1995 was 0.12 MGD. Historically water was withdrawn directly from the stream and passed through one of two sand filter beds. Overflow was discharged back to the brook. A new water filtration facility was constructed and went on-line in January 2000. The construction included a slow sand filter, storage tank, and the renovation of most of the distribution system piping. This renovation/replacement should reduce water use for the system from 0.12 MGD to an approximate use of 0.06-0.08 MGD that is under the WMA permitting threshold of 0.1 MGD.
2. In the Karner Brook subwatershed, the Catamount Ski Area is registered (#10109001) to withdraw 0.4 MGD from two sources--a well near Route 23 and a surface water withdrawal from a pond at their ski area in Egremont, MA.

NPDES:

1. The Jug End in the Berkshires, Inc. permit (MA0021938) to discharge to Fenton Brook was terminated by EPA on 16 March 1988. The facility will utilize on-site septic systems rather than maintain a surface water discharge.

USE ASSESSMENT

DEP DWM conducted benthic macroinvertebrate and fish sampling in August 1997 at two stations (KB01 and KB02) in Karner Brook to bracket the water withdrawal of the South Egremont Water Company. The upstream station was located off of Mount Washington Road upstream from the pumphouse and the downstream station was located downstream from the pumphouse. Results and the discussion of the RBPIII benthic macroinvertebrate analysis are in Appendix C.

- Bioassessment/Habitat – The benthic community showed slight impairment downstream of the water withdrawal, therefore the *Aquatic Life Use* is assessed as partial support in the downstream reach. It should be noted, however, that a new water treatment facility is being constructed that could reduce (by half) the volume of water withdrawn from Karner Brook.

- Streamflow – Estimated 7Q10 flows in Karner Brook at the water withdrawal (using a drainage area ratio transformation to Fenton Brook's 7Q10 in Reis 1999) is 0.008 cfs. The estimated August median flow in Karner Brook is 0.15 cfs.

- Fish Population - Fish sampling in Karner Brook revealed populations of cold water fishes at both sampling locations (Appendix B, Table B7). Brook trout were found upstream of the dam while brook trout and slimy sculpin were found downstream of the dam. Although it is unclear why slimy sculpin were not present upstream of the dam (possibly related to periodic drying or pooling of Karner Brook and/or the presence of the dam), it is not uncommon to see brook trout only inhabiting the uppermost reaches of first order streams.

Designated Use		Status: Karner Brook (Segment MA21-16)
Aquatic Life		SUPPORT. The upper 2.2 mile length of this segment is evaluated as supporting this use. PARTIAL SUPPORT. The lower 2.0 mile length of the segment partially supports this use based on slight impairment of the benthic macroinvertebrate community considered to be the result of reduced habitat related to flow alteration.
Fish Consumption		NOT ASSESSED.
Drinking Water		The DEP Drinking Water Program maintains current drinking water supply data.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		SUPPORT. The entire 4.2 mile length of this segment is evaluated as supporting this use.

RECOMMENDATIONS: KARNER BROOK (SEGMENT MA21-16)

- Based on the 7Q10 and August median low flow estimates by the DEP DWM, the South Egremont Water Company water withdrawal exceeds the 7Q10 flow of Karner Brook by a factor of 10. The withdrawal is estimated to reduce the August median flow in Karner Brook by approximately one half. Because of this concern, additional water quantity information should be collected for this stream to better assess the relationship between biological integrity and streamflow. This should include the development of a flow duration curve and a streamflow hydrograph.
- Continue to conduct instream biological monitoring (habitat, benthos and fish community) upstream and downstream of the water withdrawal in Karner Brook to evaluate the effectiveness of the new water treatment facility. If DWFELE endorses, designate this stream as a cold water fishery in the next revision of the SWQS.

<u>South Egremont Water Company</u>

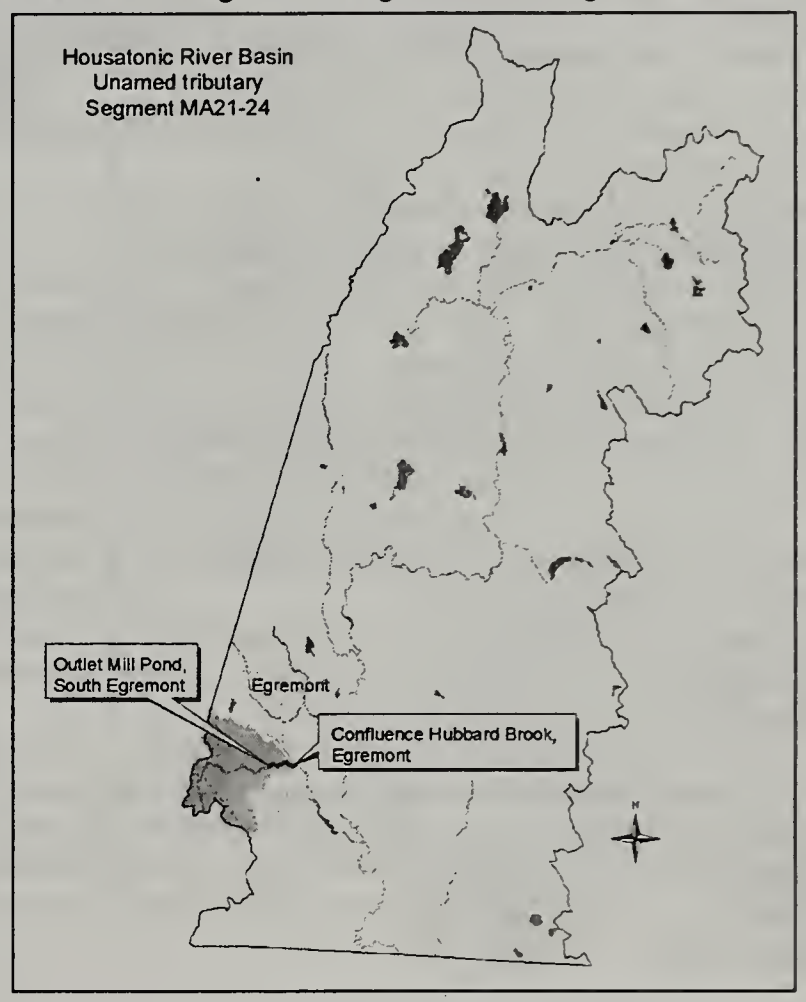
- Continue to closely monitor the South Egremont Water Company withdrawal volumes to evaluate the effectiveness of their upgraded system. The company should carefully monitor water use and water loss to avoid unnecessary withdrawals from Karner Brook, particularly during low-streamflow conditions.

UNNAMED TRIBUTARY (SEGMENT MA21-24)

Location: Outlet of Mill Pond, village of South Egremont to confluence with Hubbard Brook, Egremont.
Segment Length: 1.5 miles. Classification: Class B.

SEGMENT DESCRIPTION

This unnamed tributary meanders in an easterly direction through the village of South Egremont to its confluence with Hubbard Brook. The lower reach of the segment (downstream from Creamery Road) flows through a golf course.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	68%
Agriculture	14%
Residential	8%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	31%
Wetlands and Residential	22%
Open Land	20%

WITHDRAWALS AND DISCHARGES

None known.

USE ASSESSMENT

No sampling has been conducted in this stream (Unnamed Tributary Segment MA21-24), therefore all uses are currently not assessed.

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics

RECOMMENDATIONS: UNNAMED TRIBUTARY (SEGMENT MA21-24)

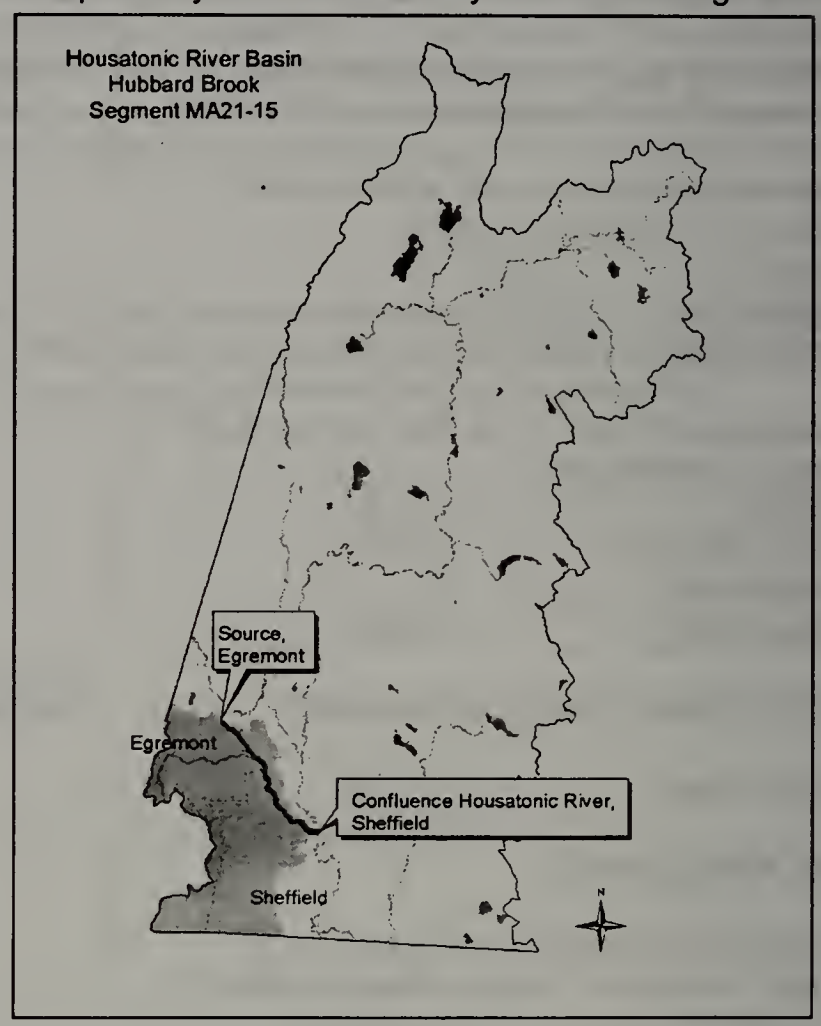
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and page IV-53-54) should be reviewed to help design future monitoring plans for the Hubbard Brook subwatershed.
- Evaluate potential water quality impacts in this stream in the vicinity of the golf course (e.g., water withdrawal, nutrient loading, riparian zone disturbances).

HUBBARD BROOK (SEGMENT MA21-15)

Location: Source northwest of Townhouse Hill Road, Egremont to confluence with Housatonic River, Sheffield. Segment Length: 9.4 miles. Classification: Class B, Cold Water Fishery.

SEGMENT DESCRIPTION

Hubbard Brook, a Class B Cold Water Fishery, flows primarily in a southeasterly direction through the southwest corner of Great Barrington where it is joined by an unnamed tributary from Root Pond. After crossing back into Egremont, Hubbard Brook is joined by the unnamed tributary from Mill Pond, and begins to meander in a southerly direction into Sheffield. It is joined by Willard Brook prior to flowing into Mill Pond in Sheffield. Hubbard Brook heads southeast as it exits Mill Pond and is fed by Schenob Brook just upstream of its confluence with the mainstem Housatonic River in Sheffield. Both Willard and Schenob brooks are part of the Schenob Brook ACEC.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	71%
Agriculture	14%
Residential	5%

Land-use estimates in the 100' riparian zone from the streambanks:

Wetlands	35%
Forest	21%
Agriculture	9%

WITHDRAWALS AND DISCHARGES

None known.

USE ASSESSMENT

The USGS initiated suspended sediment study sampling on Hubbard Brook (referred to as Schenob Brook at Sheffield MA gage 01198080) in March 1994 and continued to periodically measure suspended sediment concentrations, specific conductivity, and temperature as well as instantaneous discharge through September 1995. These data are reported in Socolow *et al.* (1996).

- Water Quality - The suspended sediment concentration measured on seven occasions ranged from 4 to 98 mg/L (Socolow *et al.* 1996). Instream temperature measurements exceeded 20°C on 7 of 11 days sampled during the summer months of 1994 and 1995 (July through September). Conductivity measurements ranged between 226 and 285 µS/cm. Backwater effects from the Housatonic River were encountered during medium to high flow situations that limited sampling (Bent 1999c).

- Fish Consumption Advisory – There is currently no specific fish consumption advisory for Hubbard Brook. The DPH fish consumption advisory in effect for the mainstem Housatonic River includes a provision that recommends that fish taken from feeder streams to the Housatonic River be trimmed of fatty tissue prior to cooking (MA DPH 1999). The intention of this provision is to minimize the potential risk associated with fish that may migrate in or out of the mainstem Housatonic River.

Too little data exists to evaluate the status of the designated uses, therefore all uses for Hubbard Brook (Segment MA21-15) are currently not assessed at this time.

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				

RECOMMENDATIONS: HUBBARD BROOK (SEGMENT MA21-15)

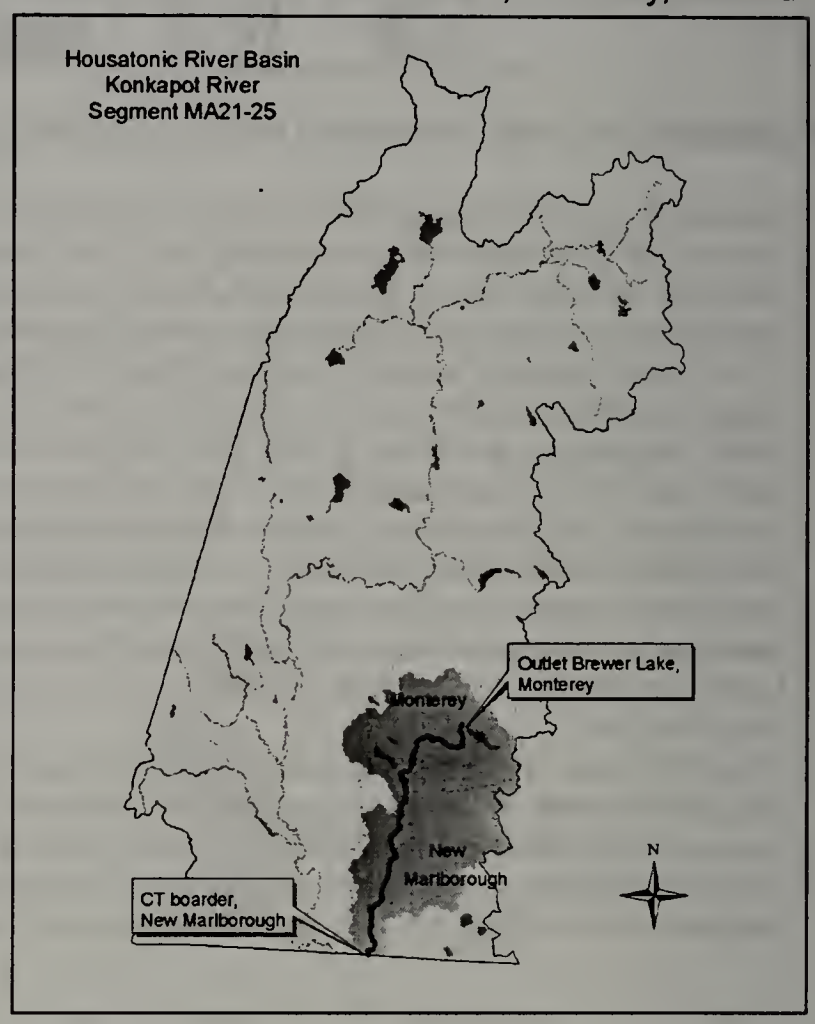
- Despite the DPH recommendation that fishes taken from tributaries to the Housatonic River should be trimmed of fatty tissue before cooking (MA DPH 1999), body burdens of PCB in the edible portion of fish from Hubbard Brook should be further investigated. Determination of natural or man-made barriers to migration in the tributaries of the Housatonic River, including Hubbard Brook, would assist in the identification of stream reaches where the potential for PCB contaminated fishes is greatest.
- Water quality monitoring has not historically been conducted in this brook since it does not receive any direct discharges, and there is very little development in the drainage basin. Monitoring may be warranted to develop baseline data (DO, pH, temperature, fecal coliform bacteria) in order to evaluate the *Primary* and *Secondary Contact Recreational* uses. Evaluate potential water quality impacts in this stream in the vicinity of the golf course located at the upstream end of this segment (e.g., water withdrawal, nutrient loading, riparian zone disturbances).
- Because of the predominance of agricultural land-use practices adjacent to the Hubbard Brook, further investigation is needed to identify potential nonpoint source pollution (e.g., riparian zone disturbances).
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and page IV-53-54) should be reviewed to help design future monitoring plans for the Hubbard Brook subwatershed.

KONKAPOT RIVER (SEGMENT MA21-25)

Location: Outlet of Brewer Lake, Monterey, to the State Line New Marlborough, MA/Caanan, CT.
Segment Length: 15.9 miles. Classification: Class B.

SEGMENT DESCRIPTION

The Konkapot River, a Class B waterbody, originates at the outlet of Brewer Lake, Monterey, MA and flows primarily in a south, southwesterly direction over the dam at the Village of Mill River and through New Marlborough into Caanan, Connecticut. The land-use patterns in this watershed area are primarily forested, although small urban centers (e.g., village of Mill River) and agricultural activities are also present.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	80%
Agriculture	10%
Wetlands	3%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	41%
Wetlands	27%
Agriculture	23%

WITHDRAWALS AND DISCHARGES

WMA:

1. Lowland Farm is registered (#10219301) to withdraw 0.04 MGD from two surface water sources in Monterey (Rawson Brook subwatershed).
2. Berkshire Trout Hatchery is registered (#10211302) to withdraw 0.33 MGD from an artesian wellfield upstream of Hartsville along the Konkapot River.

Two additional public water supplies in the Konkapot River subwatershed that are below the WMA permitting threshold of 100,000 GPD are (LeVangie 2000):

1. The Monterey Water Company has two water withdrawal sources (PWSID# 1193000-01S and 01G) near the small, unnamed tributary from the outlet of Palmer Pond in Monterey. Their system-wide withdrawal volumes are only about 11,000 GPD. In 1999 they withdrew only 3.97 million gallons. Their summer service population is 155 people and their winter service is 126 people.
2. Gould Farm in Monterey has two water withdrawals (PWS#1193003-01S and 01G) in the Rawson Brook subwatershed. The groundwater source is active and the surface water source is an emergency source. The actual system-wide withdrawal volume is very small, 2.13 million gallons in 1999. The system serves 80 people.

NPDES:

1. MA0005401 – The Berkshire National Fish Hatchery permit to discharge to a small, unnamed tributary to the Konkapot River was issued in June 1979 and never reissued. This facility, now the Berkshire Trout Hatchery, which has been "dry" for the last five years (no fish produced), has recently been purchased.
2. MA0022705 – Gould Farm discharges a monthly average flow of 0.012 MGD of treated sanitary effluent to Rawson Brook, a tributary of the Konkapot River, in Monterey. The permit was issued in 1975 and is still active.

USE ASSESSMENT

Water quality and fecal coliform bacteria data were collected by DEP DWM from 11 stations along this segment of the Konkapot River (Appendix B, Figure B2) although physicochemical (nutrients, suspended solids, hardness and alkalinity) sampling was conducted at only three of the stations (Appendix B, Table B1). Survey conditions are described in Appendix B, results – survey conditions. Benthic macroinvertebrate sampling was conducted by DEP DWM in August 1997 at eight stations in this segment of the Konkapot River (Appendix C, Figure C1). The results and discussion of the RBPIII benthic macroinvertebrate analysis can be found in Appendix C. Fish toxics monitoring by DEP was conducted in mid-October 1997 DWM in this segment of the Konkapot River at three stations, F0049, F0048, and F0047 (Appendix B, Figure B3).

- Water Quality - Although not representative of worse case (pre-dawn) conditions, the instream dissolved oxygen concentrations were not less than 7.4 mg/L (Appendix B, Table B4). Saturation ranged between 81 and 101%. The highest instream temperature (25.2°C) was recorded at station KR12, at the outlet of Brewer Lake at 13:19h. Although the majority of the temperature readings were below 20°C in this segment of the Konkapot River, 75% of the temperature readings on 22 July (collected between the outlet of Brewer Lake, Monterey and Hartsville Mill Road, New Marlborough) exceeded 20°C, the standard for a cold water fishery. The elevated temperatures were a likely result of the influence of Brewer Lake and Lake Buel on the river. The pH measurements from this segment of the Konkapot River were all above 7.0 SU, ranging between 7.5 and 8.4 SU. Conductivity increased from the outlet of Brewer Lake to where the Konkapot River enters Connecticut (KR03), most likely related to natural conditions (bedrock geology), as did hardness and alkalinity (Appendix B, Tables B4 and B5). According to USGS the Konkapot River is underlain by crystalline (60%) and carbonate (40%) (Breault and Harris 1997, Coles 1996, Grady and Mullaney 1998, and Harris 1997).

  Other water quality variables analyzed in this segment of the Konkapot River indicated low levels of nutrients (NH_3-N $\leq$ 0.02 mg/L and TP$\leq$ 0.026 mg/L) throughout the segment with the exception of nitrate-nitrogen (Appendix B, Table B5). Low nitrate levels were measured near the outlet of Brewer Lake ($\leq$ 0.02 mg/L) where the watershed land-use is primarily forest. Nitrate levels in the river increased slightly (up to 0.10 mg/L) near the village of Mill River, New Marlborough potentially a result of the extensive upstream wetlands. The 1997 DEP DWM data does not suggest problems related to suspended solids (Appendix B, Table B5), although the data set is too small and the spatial coverage too limited to capture any effects of storm water runoff. The *in-situ* turbidity dataset is also limited. Furthermore, the laboratory dataset for turbidity was consistently lower than the *in-situ* measurements, potentially an anomaly of field and/or analytical technique. No clear patterns of runoff related to changes in land-use were identified along this segment of the Konkapot River.

- Biology/habitat – The DEP DWM RBPIII benthic macroinvertebrate analysis detected slight impairment of the benthic community downstream from the outlet of Brewer Lake (KR12) probably the result of the upstream impoundment (Appendix C). Additionally, significant instream deposits (sedimentation) were observed in the KR12 sampling reach. No significant impairment was detected at any of the other seven stations (KR11, KR09, KR08, KR07, KR06, KR05, KR03) sampled in this segment (non/slightly impaired).

Based on these data the *Aquatic Life Use* is assessed as full support in this segment of the Konkapot River. Additionally the water quality data (i.e. suspended solids, turbidity) and field observations indicated no impairment to the aesthetic quality of this segment therefore the *Aesthetics Use* is also supported.

- Fish Consumption Advisory – Mercury levels in fish (brown trout and/or white sucker) collected by DEP DWM from this segment of the Konkapot River ranged between 0.08 and 0.56 mg/kg wet weight (Appendix B, Table B8). The % lipid concentrations ranged between 0.18 to 1.2. Neither PCB nor organochlorine pesticides were detected in any of the samples. Other species collected from the Konkapot River by DEP DWM included: longnose dace (*Rhinichthys cataractae*), blacknose dace (*Rhinichthys atratulus*), slimy sculpin (*Cottus cognatis)*, and common shiner (*Notropis cornutus*) (Appendix B). The DPH, using a trigger level of 0.5 mg/kg wet weight Hg, issued a Public Health Fish

Consumption Advisory on 6 February 1998 for the Konkapot River (MA DPH 1998). The advisory warns children younger than 12 years old, pregnant women and nursing mothers not to eat fish from the Konkapot River from the village of Mill River to the confluence with the Housatonic River. The advisory also recommends that the general public should limit consumption of all fish caught from this segment of the Konkapot River to two meals per month. Based on this advisory, the *Fish Consumption Use* is assessed as non-support for the lower 6.1 miles (downstream from the dam at Mill River) because of high mercury in fish flesh.

Mercury contamination in edible fillets of freshwater fishes in Massachusetts is not uncommon. In 1994, DPH issued a statewide *Interim Freshwater Fish Consumption Advisory* for mercury (MA DPH 1994). This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. The advisory encompasses all freshwaters in Massachusetts. Mercury contamination can be the result of both near- and far-field point and nonpoint sources. DEP recognizes that other local sources of mercury do exist, and that waters covered by the statewide advisory, as well as site-specific advisories, may in fact be impacted by unconfirmed local sources and/or by atmospheric deposition. Despite the fact that mercury concentrations in fish collected from the Konkapot River above the dam at Mill River did not exceed 0.28 mg/kg wet weight, the *Fish Consumption Use* in the upper 9.8 mile reach of the Konkapot River is not assessed (precluded by the statewide advisory).

Because of the statewide advisory, the upper 9.8 mile reach of this segment of the Konkapot River is not assessed for the *Fish Consumption Use*. This use is assessed as non-support for the lower 6.1 miles (downstream from the dam at Mill River) due to DPH's Konkapot River fish consumption advisory.

Note: In response to the fish toxics monitoring data and subsequent Fish Consumption Advisory, screening work was performed by DEP DWM to determine the presence/absence of mercury in the sediments of the upper (above the dam at Mill River) and lower (above the dam at Ashley Falls) Konkapot River. Streambed sediments located behind dams are quite often the ultimate sink for a wide variety of environmental pollutants. Many contaminants are ubiquitous in nature and can be the result of such natural processes as forest fires, volcanic activity and microbial synthesis (Eisler 1987), however, anthropogenic activities mobilize these substances, often causing them to be enriched or concentrated above natural or baseline levels. On 19 May 1998, a sediment sample was collected by DEP DWM approximately 10 m above the dam at Mill River (station KR07A) in a depositional area near the eastern bank. Mercury was not detected (Appendix B, Table B9).

Waste Site Cleanup File Review: In October 1986, DEP's Bureau of Waste Site Cleanup (BWSC) in the Western Regional Office (WERO) received a complaint from the New Marlborough Conservation Commission regarding an abandoned dump on the banks of the Umpachene River (MA DEP 1999b). The Umpachene River is a major tributary to the Konkapot River draining approximately 8.5 mi^2 of central New Marlborough and its village of Southfield. The dump was alleged to have been associated with a local tannery. According to DEP records, BWSC personnel investigated the alleged dump site located just upstream of Norfolk Road at its intersection with Mill River Southfield Road and New Marlborough Southfield Road. Limited water column and sediment sampling in the Umpachene River was conducted (5 February and 18 June 1987) to determine if the dump was a source of contamination to the river. The samples were analyzed for EPA Priority Pollutant Metals and volatile organic compounds (VOCs). Based on the sampling results at the time of investigation, the site was not considered a priority for further investigation by DEP, although the owner was required to submit additional information gathered from local records. In May 1988 the case (1-0121) was closed and the property was removed from the M.G.L. C.21E Site List (MA DEP 1999b). One sediment sample collected in the Umpachene River in the vicinity of the alleged dump was found to contain 0.55 mg/kg of mercury. No upstream sediment sample was collected due to the lack of soft substrate.

- Fecal Coliform Bacteria - The fecal coliform bacteria counts from the 11 stations sampled by DEP DWM along this segment of the Konkapot River ranged between <20 and 140 cfu/100 mls (Appendix B, Table B6). Both the *Primary* and *Secondary Contact Recreational Uses* are therefore evaluated as full support.

Designated Use		Status: Konkapot River (Segment MA21-25)
Aquatic Life		SUPPORT. The entire 15.9 mile length of this segment is assessed as supporting this use.
Fish Consumption		NOT ASSESSED. The upper 9.8 miles of this segment are not assessed for this use because of the statewide fish consumption advisory. NON-SUPPORT. The lower 6.1 miles do not support this use because of the DPH Fish Consumption Advisory for high mercury in fish flesh.
Primary Contact		SUPPORT. The entire 15.9 mile length of this segment is assessed as supporting this use.
Secondary Contact		SUPPORT. The entire 15.9 mile length of this segment is assessed as supporting this use.
Aesthetics		SUPPORT. The entire 15.9 mile length of this segment is assessed as supporting this use.

RECOMMENDATIONS: KONKAPOT RIVER (SEGMENT MA21-25)

- Designate the Konkapot River as a Cold Water Fishery, with DFWELE support, in the next revision of the Massachusetts Surface Water Quality Standards.
- An investigation into the sources of sediment inputs to the Konkapot River near Bear Mountain Road, Monterey should be conducted (Appendix C). BMPs should be implemented if needed.
- The results of the benthic macroinvertebrate analysis indicated non/slight impairment in the Konkapot River in the vicinity of Mill River village, potentially related to organic enrichment. Although currently considered to be fully supporting the *Aquatic Life Use*, additional monitoring is necessary to determine if a downward trend in water quality resulting from development along this section of the river is occurring. Heavy applications of sand during the winter should be discouraged along this portion of Clayton-Mill River Road, or BMPs should be implemented to trap washout and prevent sand migration into the stream. Biomonitoring is recommended during the next Housatonic River Basin survey.
- Additional sampling is necessary to determine whether or not the presence of mercury in the sediments and fishes of the Konkapot River is a result of a potential point source within the watershed, a diffuse nonpoint source (i.e., atmospheric deposition), and/or from a natural source (i.e., crustal). It is unclear at this time whether or not mercuric compounds were utilized in the tanning process during the 1800s. The screening surveys conducted to date were not designed to assess the variability of mercury in the streambed sediments of the Konkapot River nor to determine whether the mercury in the sediment above the Mill River Dam was significantly lower than in the sediment above the Ashley Falls Dam. Several factors need to be taken into account in the design of any future monitoring plan to evaluate mercury contamination in the Konkapot River Watershed. Since sediment mercury concentrations can be highly variable, an increase in the number of sediment samples at each site would be necessary to account for variability and perhaps to determine significant differences in mercury concentrations between sites. Secondly, the fish collected in 1997 exhibited size/age variations between sites. Standardization of fish size/age would help to clarify differences in mercury concentrations. Finally, due to the fact that DFWELE stocks brown trout in the Konkapot River, these fish must be clearly identifiable so that wild brown trout are targeted in future fish toxics monitoring efforts.
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and page IV-54-55) should be reviewed to help design future monitoring plans for the Konkapot River subwatershed.

RECOMMENDATIONS - Continued: KONKAPOT RIVER (Segment MA21-25)

Berkshire Trout Hatchery

- Determine whether or not WMA and/or NPDES permits for the Berkshire Trout Hatchery (formerly Berkshire National Fish Hatchery) will be required. Develop permits if necessary.

Gould Farm

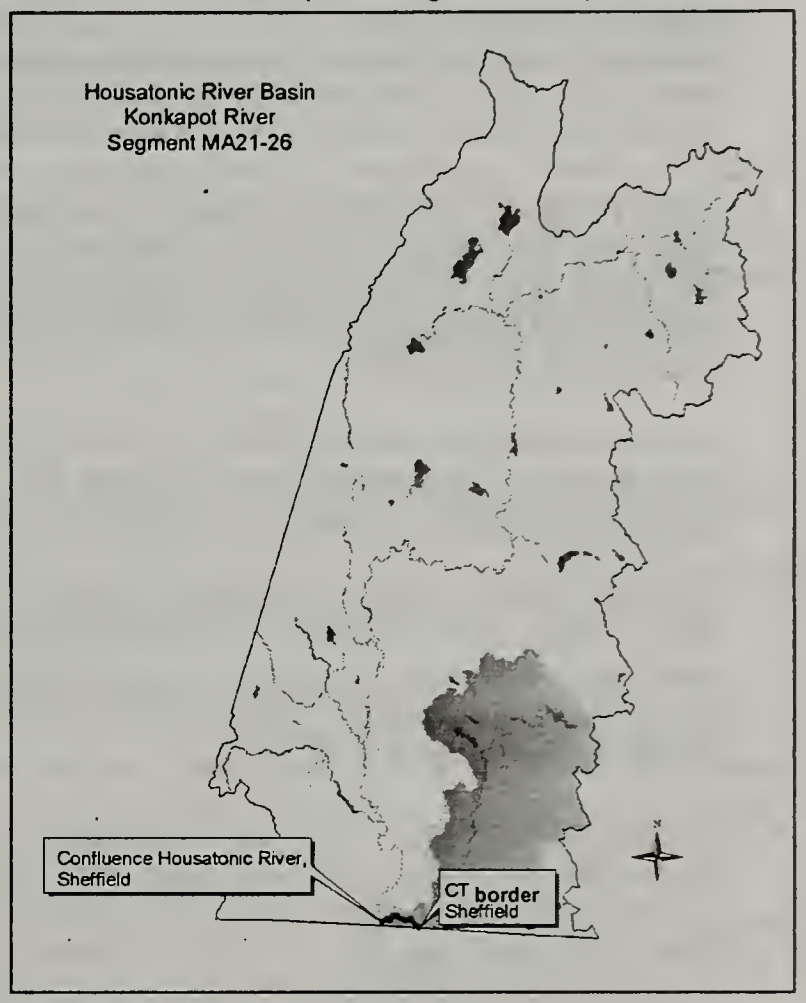
- The Gould Farm NPDES permit (MA0022705) should be reissued with appropriate limits/monitoring requirements.

KONKAPOT RIVER (SEGMENT MA21-26)

Location: From the Connecticut State Line Sheffield, MA/Caanan, CT to the confluence with the Housatonic River, Sheffield. Segment Length: 2.8 miles. Classification: B.

SEGMENT DESCRIPTION

After flowing 2.2 miles through forests and active agricultural farmlands (including livestock) in Caanan, CT, the Konkapot River flows back into Massachusetts in Sheffield. The river meanders 2.8 miles through Sheffield in a westerly direction, over the dam at Ashley Falls to its confluence with the Housatonic River.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	79%
Agriculture	10%
Residential	4%

Land-use estimates in the 100' riparian zone from the streambanks:

Agriculture	50%
Forest	33%
Wetlands	10%

WITHDRAWALS AND DISCHARGES

None known.

USE ASSESSMENT

In 1997 DEP DWM collected water quality data at multiple stations in this segment of the Konkapot River (Appendix B, Figure B2). *In-situ* Hydrolab data were collected at three stations including two stations (KR03 and KR02) in North Canaan, CT. Instream physico/chemical data were collected at one station, KR01, in Ashley Falls. Survey conditions are described in Appendix B, results – survey conditions. Fecal coliform bacteria data were collected at six stations, three of which were located in North Canaan, CT. The bacteria sampling (stations KR03A, KR03, KR02A, KR02, KR01A and KR0), extended into the spring of 1998. USGS initiated a suspended sediment study on the Konkapot River in March 1994 and continued to periodically measure suspended sediment concentrations, specific conductivity, and temperature as well as instantaneous discharge through April 1996. These data are reported in Socolow *et al.* (1996) and Socolow *et al.*, (1997). Benthic macroinvertebrate sampling was conducted by DEP DWM in August 1997 at two stations in this segment of the Konkapot River (Appendix C, Figure C1). Fish toxics monitoring, conducted on 26 August 1997, was initially conducted by DEP DWM in part to determine whether or not fish in the lower Konkapot River (below the dam at Ashley Falls) with migratory access to the Housatonic River bioaccumulate PCB. Fish sampling was conducted both upstream and downstream of the dam (stations F0046 and F0045, respectively) (Appendix B, Figure B3). The USGS, as part of the NAWQA study, sampled fish and sediment from the Konkapot River at Ashley Falls upstream from the dam. Sediment was collected in August 1994 on the upstream side of the Route 7 bridge along the eastern bank. According to USGS (Breault and Harris 1997), fine-grained streambed sediments were collected from a variety of depositional settings within the stream reach and composited. The samples were collected from the top 1-2 cm using a stainless steel scoop following national consistent protocols (Shelton and Capel 1994 as cited in Breault and Harris 1997). Samples collected for inorganic-constituent analysis were wet-sieved through a 63-μm polyethylene sieve, digested to complete dissolution, and analyzed.

- Water Quality - Although not representative of worse-case (pre-dawn) conditions, the instream dissolved oxygen concentrations measured by DEP DWM were not less than 8.6 mg/L (Appendix B, Table B4). Saturation ranged between 81and 97%. None of the temperature measurements exceeded 18.3°C. The pH measurements ranged between 7.8 and 8.0 SU. Conductivity, alkalinity and hardness at sampling station KR01 were the highest measured in the Konkapot River and are most likely related to natural conditions (bedrock geology) (Appendix B, Table B5). Other water quality variables analyzed at this station indicated low levels of nutrients (NH_3-N $\leq$ 0.02 mg/L and TP$\leq$ 0.02 mg/L) although nitrate levels were the highest measured (up to 0.53 mg/L). These samples were collected under both dry and wet weather sampling conditions (Appendix B, results - survey conditions). Agricultural activities located in close proximity to the river upstream of the sampling location may have resulted in the increased nitrate concentration.

  While the 1997 DEP DWM data suggest that there are no problems related to suspended solids ($\leq$ 2.8 mg/L), the data set is too small to capture any effects of storm water runoff (Appendix B, Table B5). The single *in-situ* vs. laboratory turbidity measurement at KR01 is an anomaly, potentially the result of field (sample collected in a bucket) and/or analytical technique, therefore the results are inconclusive (Appendix B, Table B4).

  The daily mean suspended sediment concentration measured by USGS ranged between 1 and 720 mg/L during the 66 days sampled (Socolow *et al.* 1996 and Socolow *et al.* 1997). High levels of suspended sediment appear to be the result of runoff events and decrease quickly thereafter.

- Sediment Quality – The concentration of mercury in the USGS sample was 0.88 µg/g dry weight (Harris 1997), and grain size distribution was primarily sand (91%), silt (8.9%) and clay (0.3%). PCB were below detection (<50µg/kg dry weight) in the sediment of the Konkapot River (Harris 1997). Iron was at the S-EL guideline. Several trace metals (Cr, Cu, Pb, Mn, Ni, and Zn) exceeded the L-EL guidelines (in Persaud *et al.* 1993).

- Biology/habitat - Slight impairment was detected in the Konkapot River just prior to its re-entering the state of MA at the upstream end of this segment (KR02), which appeared to be the result of mild organic enrichment (Appendix C). The analysis of the benthic community in the Konkapot River downstream from the dam at Ashley Falls was borderline between the non to slightly impaired. Attached filamentous algae were also present at both stations. Though not yet indicative of a serious problem, these data should serve as an alert to review land management practices to minimize both sediment and nutrient loading from nonpoint source pollution (i.e., road runoff, agriculture) to the lower Konkapot River.

Based on these data, the *Aquatic Life Use* is assessed as partial support in this segment of the Konkapot River. While water quality (i.e. suspended solids, turbidity) and field observations indicated slight to no impairment to the aesthetic quality of this segment the *Aesthetics Use* is supported.

- Fish Consumption Advisory - Three brown trout (*Salmo trutta*) and one white sucker (*Catostomus commersoni*) were collected by DEP DWM from the Konkapot River above the dam at Ashley Falls (station F0046). Three fish, a brown trout, a largemouth bass (*Micropterus salmoides*), and a white sucker, were collected downstream of the dam (station F0045). All seven fish were analyzed individually for metals (As, Cd, Pb, Hg, and Se), PCB, organochlorine pesticides, and percent lipids. Arsenic, cadmium, and lead were not detected in the edible fillets of any sample analyzed nor were any organochlorine pesticides (Appendix B, Table B8). Selenium was detected in all samples analyzed ranging from 0.158 to 0.421 mg/kg wet weight. Elevated concentrations of mercury in fish tissue at both stations (0.41 – 1.06 mg/kg wet weight) was documented. The % lipid concentrations ranged between 0.21 to 1.5. PCB were only detected (0.08 µg/g wet weight) in the individual brown trout collected below the dam.

  The concentration of PCB in the whole white sucker composite (comprised of eight fish) sample collected by USGS from the Konkapot River upstream of the dam at Ashley Falls was 50 µg/kg wet weight (Coles 1998). The DDT concentration was 17 µg/kg wet weight. Neither the PCB nor the DDT

levels exceeded the NAS/NAE guidelines (500 µg/kg PCB, 1,000µg/kg DDT wet weight) for the protection of fish eating wildlife (in Coles 1998). Chlordane was not detected.

The DPH, using a trigger level of 0.5 mg/kg wet weight Hg, issued a Public Health Fish Consumption Advisory on 6 February 1998 for the Konkapot River (MA DPH 1998). The advisory warns children younger than 12 years old, pregnant women and nursing mothers not to eat fish from the Konkapot River from the village of Mill River to the confluence with the Housatonic River. The advisory also recommends that the general public should limit consumption of all fish caught from this segment of the Konkapot River to two meals per month. Based on this advisory, the *Fish Consumption Use* is assessed as non-support for this segment of the Konkapot River.

[Note: In response to the fish toxics monitoring data and subsequent Fish Consumption Advisory, screening work was performed by DEP DWM to determine the presence/absence of mercury in the sediments of the upper (above the dam at Mill River) and lower (above the dam at Ashley Falls) Konkapot River. On 19 May 1998, sediment samples were collected approximately 15m above the dam at Ashley Falls in a depositional area near the northern bank and from an erosional area along the southern bank. The concentration of mercury in the coarse grained sediment samples collected by DEP DWM exceeded the S-EL published by Persaud *et al.* (1993) in the sample collected from the depositional area (Appendix B, Table B9). The sediment sample collected from the erosional area was at the L-EL level.]

The DPH fish consumption advisory in effect for the mainstem Housatonic River includes a provision that recommends that fish taken from feeder streams to the Housatonic River be trimmed of fatty tissue prior to cooking (MA DPH 1999). The intention of this provision is to minimize the potential risk associated with fish that may migrate in or out of the mainstem Housatonic River.

- Fecal Coliform Bacteria - The fecal coliform bacteria data from this segment of the Konkapot River ranged between 140 and 700 cfu/100 mls, which is higher than those recorded from the upstream segment (Appendix B, Table B6). These data are similar those collected in 1992 (Dunn 1994), which led to the listing of this segment as impaired for *Primary Contact Recreation* (MA DEP 1999a). The ability to differentiate between wet and dry weather sampling conditions is difficult for this dataset (Appendix B, results – survey conditions) since it was necessary to extrapolate Konkapot River streamflow conditions from the USGS gage on the Housatonic River at Great Barrington. Since only two out of eight samples (25%) exceeded 400 cfu/100 mls during dry weather conditions and none exceeded 2,000 cfu/100 mls (wet weather guidance), the *Primary Contact Recreational Use* is assessed as partial support and the *Secondary Contact Recreational Use* is assessed as support.

Designated Use		Status: Konkapot River (Segment MA21-26)
Aquatic Life		PARTIAL SUPPORT. The entire 2.8 mile length partially supports the *Aquatic Life Use* based on slight impairment to the benthic community potentially a result of mild organic enrichment.
Fish Consumption		NON-SUPPORT. The entire 2.8 mile length of this segment does not support this use because of a DPH Fish Consumption Advisory due to high mercury in fish flesh.
Primary Contact		PARTIAL SUPPORT. The entire 2.8 mile length of this segment partially supports this use based on elevated levels of fecal coliform bacteria.
Secondary Contact		SUPPORT. The entire 2.8 mile length of this segment supports this use.
Aesthetics		SUPPORT. The entire 2.8 mile length of this segment supports this use.

RECOMMENDATIONS: KONKAPOT RIVER (SEGMENT MA21-26)

- Designate the Konkapot River as a Cold Water Fishery, with DFWELE support, in the next revision of the Massachusetts Surface Water Quality Standards.
- DPH should review the PCB dataset from the Konkapot River and make any necessary changes to the Housatonic River fish consumption advisory.
- Further investigation (bracketing of major land-use changes) is necessary to identify and quantify anthropogenic sources of sediment input(s) into this reach of the Konkapot River. Subsequently, BMPs should be implemented to control erosion and reduce sediment inputs to the Konkapot River. At a minimum, BMPs are needed at the Route 7A crossing to control road runoff.
- The results of the benthic macroinvertebrate analysis indicated slight impairment in this segment of the Konkapot River, potentially related to organic enrichment (Appendix C). Additional monitoring is necessary to determine any trends in water quality as a result of land-use activities. Adjacent agricultural activities are one obvious potential source of nutrient loadings, however other upstream sources may exist as well. Restoration of the riparian zone along the Konkapot River upstream of Route 124 in Caanan, CT may help to minimize NPS loadings.
- Biomonitoring in the Konkapot River at DEP DWM stations KR02 and KR01 is recommended during the next Housatonic River Basin survey.
- Additional sampling would be necessary to determine whether or not the presence of mercury in the sediments and fishes of the Konkapot River is a result of a potential point source within the watershed, a diffuse nonpoint source (i.e., atmospheric deposition), and/or from a natural source (i.e., crustal). It is unclear at this time whether or not mercuric compounds were utilized in the tanning process during the 1800s. This survey was not designed to assess the variability of mercury in the streambed sediments of the Konkapot River nor to determine whether the mercury in the sediment above the Mill River Dam was significantly lower than in the sediment above the Ashley Falls Dam. There are several factors that need to be taken into account in the design of future monitoring studies of mercury contamination in the Konkapot River Watershed. Since sediment mercury concentrations can be highly variable, an increase in the number of sediment samples at each site would be necessary to account for variability and perhaps to determine significant differences in mercury concentrations between sites. Secondly, the fish collected in 1997 exhibited size/age variations between sites. Standardization of fish size/age would help to clarify differences in mercury concentrations. Finally, due to the fact that DFWELE stocks brown trout in the Konkapot River, these fish must be clearly identifiable so that wild brown trout are targeted in future fish toxics monitoring efforts.
- The BRPC report entitled *Assessment of Land-use Activities* and *Nonpoint Source Pollution in the Housatonic River Watershed* contains an up-to-date summary of existing and potential nonpoint sources of pollution in the Housatonic River Basin (Berkshire Regional Planning Commission 1999). The potential pollution sources identified in this report (e.g., Table IV-13 and page IV-54-55) should be reviewed to help design future monitoring plans for the Konkapot River subwatershed.

HOUSATONIC RIVER BASIN - LAKE SEGMENT ASSESSMENTS

A total of 32 lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) have been assessed in the Housatonic River Watershed. Eleven of the lakes 32 lakes assessed are less than 50 acres in total surface area. The lakes surveyed in 1997 are located wholly or partly within 19 different communities and are fairly evenly distributed among them. Of the 5,227 acres of lakes in the Housatonic River Basin, 81%, or 4,254 acres, was assessed during the 1997 surveys. Designated water supplies (i.e., Class A) accounted for 12% (or 530 acres) of the assessed acreage.

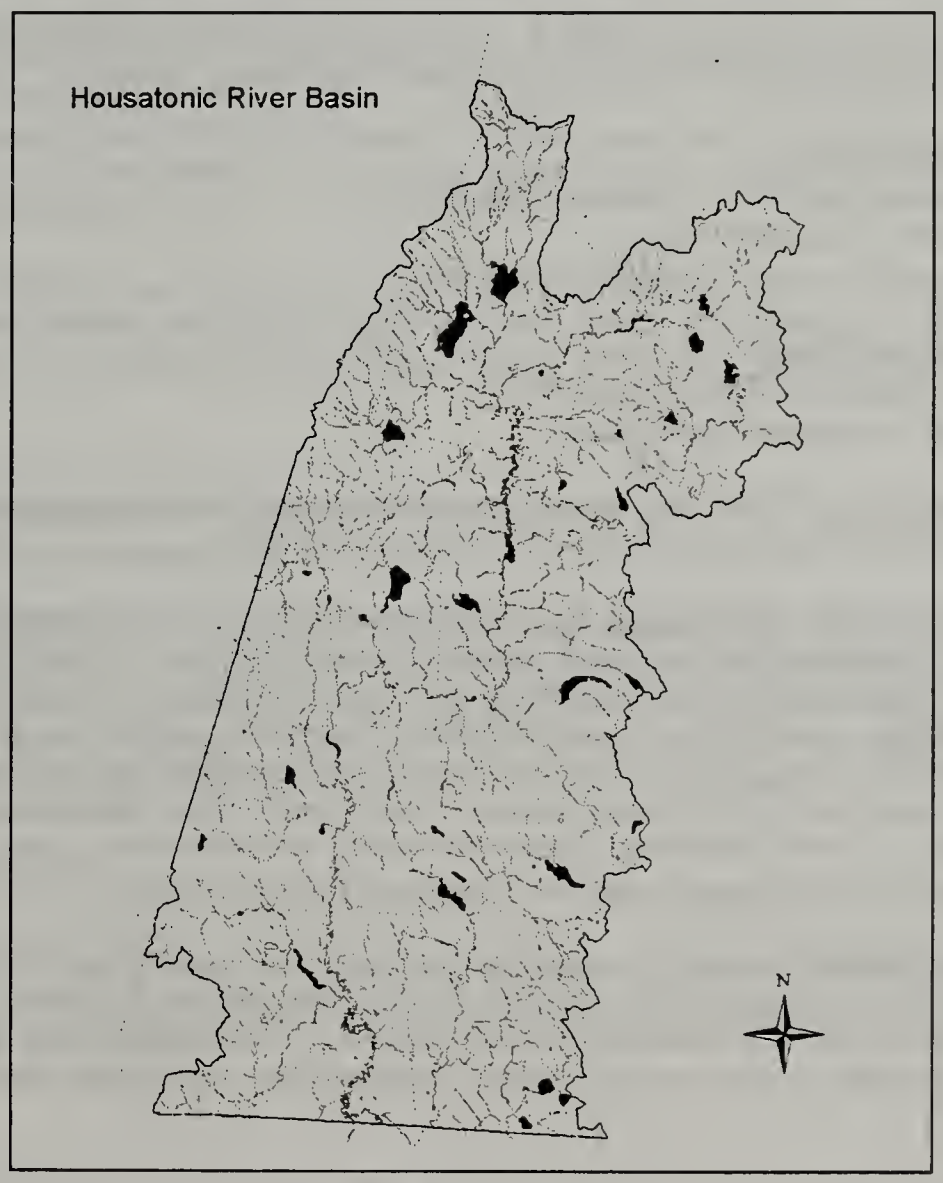


Figure 5. Location of Massachusetts lakes assessed in the Housatonic River Basin.

LAKE USE ASSESSMENTS

Synoptic surveys were conducted by DEP DWM, during the summer of 1997, at a total of 32 lakes in the Housatonic River Basin. Surveys consisted of taking observations from at least one access point on each lake (multiple access points on larger lakes). At each lake, an attempt was made to observe the entire surface area to determine the extent of areal macrophyte cover. The trophic status of each lake was estimated and the presence of non-native aquatic and/or wetland plant species was also noted (Appendix B, Table B10). The data gathered during these synoptic surveys, as well as DPH Fish Consumption Advisories (DPH 1999), were used to assess the status of the designated uses.

AQUATIC LIFE

Individual lake assessments are presented in Table 6. Three non-native, aquatic species and two non-native, wetland species were observed in the Housatonic River Basin lakes, as follows.

Non-native Aquatic Plants

Myriophyllum spicatum - Eurasian water milfoil
Najas minor - European naiad
Potamogeton crispus - Curly leaf pondweed

Non-native Wetland Plants

Lythrum Salicaria - Purple loosestrife
Phragmites australis - Reed grass

Of the 32 lakes surveyed, 15, or 47% had a confirmed non-native aquatic macrophyte observed. In the case of wetland species 16, or 50%, lakes had non-natives associated with them.

Non-native plant species represent a special cause of impairment that is not always directly related to the eutrophication process. Since these species are introduced from other parts of the country or world they are generally free from the natural control mechanisms (e.g., insects or diseases) that keep most native plant populations in check. Without controls the populations of many non-native species can grow rapidly to out-compete native plant species. This growth habit is termed invasive. It throws the biological community out of balance and can impair uses such as swimming (*Primary Contact*) and boating (*Secondary Contact*). In Massachusetts, the Division of Watershed Management is tracking the distribution of about a dozen of these non-native aquatic and wetland plant species and the impairment they are causing.

The distribution of these species is frequent to widespread, often in headwater areas, and since these species have good potential for spreading, it is likely that they have established themselves in unsurveyed lakes, segments of tributaries, and the mainstem Housatonic River. The listings in Table 5 indicate where non-native, aquatic species have been observed (**in bold**) and the likely, or potential, avenues of downstream spreading.

Lakes exhibiting impairment of the *Aquatic Life Use* because of macrophyte cover were noted as either partial or non-support (Table 6). However, if a lake met these criteria it, or part of its area, was listed as "not assessed" because no dissolved oxygen data were available.

The USGS NAWQA study sampled one site in Woods Pond for both fish tissue and sediment (Coles 1998 and Harris 1997). PCB data from sediments and biota have been collected by various agencies as part of the GE Company Pittsfield waste site cleanup investigations (Stefanosky 1998). Blasland, Bouck, and Lee, Inc. (1999) collected young-of-the-year fish for PCB analysis in 1994 and 1998 from a station (WP1) in Woods Pond. As Woods Pond is an impoundment of the Housatonic River, these data are also discussed in segment MA21-04, Housatonic River from the confluence of Southwest Branch Housatonic River and West Branch Housatonic River, Pittsfield to Outlet of Woods Pond, Lee/Lenox.

<u>Woods Pond</u>

- Tissue Chemistry:
  1. NAQWA - The concentration of PCB in the whole fish composite sample (comprised of eight white suckers, *Catastomas commersoni*) collected from Woods Pond was 72,000µg/kg wet weight (Coles 1998). This level of PCB greatly exceeded (144 times) the NAS/NAE guideline for total

PCB (in Coles 1998) of 500µg/kg wet weight for the protection of fish-eating wildlife. Chlordane was not detected in the white sucker composite sample. The DDT concentration was 260µg/kg wet weight, which did not exceed the NAS/NAE guideline for total DDT (in Coles 1998) of 1,000µg/kg wet weight for the protection of fish-eating wildlife.

2. Blasland, Bouck, & Lee, Inc. (1999) – The concentration of PCB in young-of-the-year fish collected at station WP1 was between 15,000 and 38,000 µg/kg wet weight (PPB) in largemouth bass, yellow perch, and bluegill. All of these data exceed (30 to 80 times) the NAS/NAE guideline for total PCB (in Coles 1998) of 500µg/kg wet weight for the protection of fish-eating wildlife.

- Sediment Chemistry:
  1. In Woods Pond, total PCB ranged between 0.07 and 210 PPM dry weight in the 42 samples analyzed in sediment samples collected to a depth of ≤ 1 ft. (Stefanosky 1999). One sample was less than the L-EL of 0.07 PPM while 67 and 36% of the samples exceeded the S-EL of 5.3 and 53 PPM, respectively.
  2. High concentrations (20 PPM dry weight) of PCB were also measured (sample collected 15 May 1996) as part of the NAWQA study in the sediment of the Housatonic River in Woods Pond (Breault and Harris 1997).

PCB data from sediments and biota have been collected by various agencies as part of the GE Company Pittsfield waste site cleanup investigations (Stefanosky 1998). In September 1995, largemouth bass were collected from the Laurel Lake by Blasland, Bouck & Lee, Inc. (1996) and analyzed as scales off/skin on fillets.

Laurel Lake

Total PCB concentrations in fish tissue were not detected in four of the five samples and were low (65 PPB wet weight) in one sample.

PCB data from sediments and biota have been collected by various agencies as part of the GE Company Pittsfield waste site cleanup investigations (Stefanosky 1998). Blasland, Bouck, and Lee, Inc. (1999) collected young-of-the-year fish samples for PCB analysis in 1998 from Glendale Dam. As Risingdale is an impoundment of the Housatonic River, these data are also discussed in segment MA21-19, Housatonic River from Outlet of Woods Pond, Lee/Lenox to the outlet of Risingdale Impoundment, Great Barrington.

Risingdale Impoundment

The concentration of total PCB in surficial sediment (less than 12 inches) of the Housatonic River in Rising Pond (also know as Risingdale Impoundment) ranged from detectable levels to 26 PPM (Blasland, Bouck & Lee, Inc. 1991, 1992 and 1996). The sediment total PCB data in the 1992 Addendum report (the only report that included TOC data) did not exceed the S-EL guideline however all the total PCB data exceeded the L-EL guideline (0.07 PPM).

Table 5. Non-native, aquatic species locations (**in bold**) and possible paths of downstream spreading (MA DEP 1998).

Myriophyllum spicatum **(Eurasian water milfoil)**

-- **Pontoosuc Lake** (Pittsfield/ Lanesborough) ⇒ West Branch Housatonic River ⇒ Housatonic River
Onota Lake (Pittsfield/ Richmond) ⇒ Onota Brook ⇒⇑
(through Woods Pond, several unnamed impoundments, Risingdale Impoundment)

-- **Richmond Pond** (Pittsfield/ Richmond) ⇒ Southwest Branch Housatonic River ⇒ Housatonic River
(through Woods Pond, several unnamed impoundments, Risingdale Impoundment)

-- **Ashmere Lake** (Hinsdale) ⇒ Bennett Brook ⇒ East Branch Housatonic River ⇒ Housatonic River
Plunkett Reservoir (Hinsdale) ⇒ Frisell Brook ⇒⇑
(through Center Pond, Woods Pond, several unnamed impoundments, Risingdale Impoundment)

-- **Laurel Lake** (Lee/ Lenox) ⇒ unnamed tributary ⇒ Housatonic River
(through several unnamed impoundments, Risingdale Impoundment)

-- **Upper Goose Pond** (Lee/Tyringham) ⇒ **Goose Pond** (Lee/ Tyringham) ⇒ Goose Pond Brook ⇒ Housatonic River
Greenwater Lake (Becket) ⇒ Greenwater Brook ⇒⇑
(through several unnamed impoundments, Risingdale Impoundment)

-- **Stockbridge Bowl** (Stockbridge) ⇒ Larrywaug Brook ⇒ Housatonic River
Lake Averic (Stockbride) ⇒ wetland ⇒⇑
(through unnamed impoundments, Risingdale Impoundment)

-- **Mansfield Pond** (Great Barrington) ⇒ unnamed tributary ⇒ Housatonic River

-- **Long Pond** (Great Barrington) ⇒ Long Pond Brook (through a few small impoundments) ⇒ Seekonk Brook ⇒ Green River ⇒ Housatonic River

-- **Lake Buel** (Monterey/ New Marlborough) ⇒ unnamed tributary ⇒ Konkapot River ⇒ Housatonic River

-- **Thousand Acre Swamp Pond** (New Marlborough) ⇒ Whiting River (into CT) ⇒ Housatonic River

Najas minor **(European naiad)**

-- **Pontoosuc Lake** (Pittsfield/ Lanesborough) ⇒ see description above for *Myriophyllum spicatum*

-- **Onota Lake** (Pittsfield/ Richmond) ⇒ see description above for *Myriophyllum spicatum*

-- **Richmond Lake** (Pittsfield/ Lanesborough) ⇒ see description above for *Myriophyllum spicatum*

-- **Plunkett Reservoir** (Hinsdale) ⇒ see description above for *Myriophyllum spicatum*

-- **Laurel Lake** (Lee/ Lenox) ⇒ see description above for *Myriophyllum spicatum*

-- **Lake Buel** (Monterey/ New Marlborough) ⇒ see description above for *Myriophyllum spicatum*

Potamogeton crispus **(Curly leaf pondweed)**

-- **Pontoosuc Lake** (Pittsfield/ Lanesborough) ⇒ see description above for *Myriophyllum spicatum*

-- **Onota Lake** (Pittsfield/ Richmond) ⇒ see description above for *Myriophyllum spicatum*

-- **Goose Pond** (Lee/ Tyringham) ⇒ see description above for *Myriophyllum spicatum*

-- **Mansfield Pond** (Great Barrington) ⇒ see description above for *Myriophyllum spicatum*

FISH CONSUMPTION

In April 1982 the state issued a fish consumption advisory for the Housatonic River. The advisory recommended that the general public should not consume fish, frogs and turtles from the Housatonic River between Dalton and Sheffield because of PCB contamination. In 1995, DPH updated their advisory to include a recommendation that fish taken from feeder streams to the Housatonic River should be trimmed of fatty tissue prior to cooking (MA DPH 1999). Additionally, in 1994, DPH issued a statewide *Interim Freshwater Fish Consumption Advisory* for mercury (MA DPH 1994). This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption (MA DPH 1994).

There are four lakes affected by non-consumption advisories in the watershed (Table 6). The DPH advisory for Pontoosuc Lake, Pittsfield/Lanesborough, recommends that children under 12 years of age, pregnant women, and nursing mothers should not consume any fish from Pontoosuc Lake because of a mercury hazard. All others should limit consumption of largemouth bass to two (2) meals per month (MA DPH 1999).

The three remaining lakes (Center Pond in Dalton, Woods Pond in Lee/Lenox, and Risingdale Impoundment in Great Barrington) are all affected by the DPH advisory for the mainstem Housatonic River from Dalton to Sheffield related to PCB contamination from the GE Pittsfield Company (MA DPH 1999).

PRIMARY AND SECONDARY CONTACT RECREATION AND AESTHETICS

Because the synoptic surveys focus on just three criteria (macrophyte cover, transparency, and biocommunity modifications) only a few uses could be assessed fully (Appendix B, Table B10). Since macrophyte cover is the only criterion used to assess the *Secondary Contact Recreation*, this use category was assessed at each lake surveyed (Table 6). Lakes exhibiting impairment of the *Primary Contact Recreation Use* (swimmable) because of macrophyte cover and/or transparency were noted as either partial or non-support. However, if a lake met these criteria it, or part of its area, was listed as not assessed because no data were available for fecal coliform bacteria. The *Aesthetic Use* category was generally assessed at the same level of impairment as the more severely impaired recreational use (*Primary* or *Secondary Contact Recreation*).

SUMMARY

Due to the focus of the surveys conducted, the major cause of impairment was aquatic plants (either noxious-native or non-native). Turbidity was also noted occasionally as a cause (Table 6). These causes may reflect symptoms of lake succession, a process of enrichment that can be accelerated from excessive plant nutrients and sediments being introduced to the lakes from cultural activities. This phenomenon is also reflected in the distribution of lake trophic conditions, which is skewed toward the more eutrophic categories. Additional causes of impairment include metals (mercury) and priority organics (PCB) associated with the DPH fish consumption advisories.

The sources of impairment are largely unknown, at least based on direct knowledge. However, it can be surmised that nutrients delivered from storm water runoff, failing substandard sewage disposal systems, and other non-point sources are likely to cause the increased algal or macrophyte productivity that has resulted in impairments. The exception to this is the source of PCB contamination, a result of the GE Pittsfield Company. This contamination has resulted in a DPH fish consumption advisory which impairs the *Fish Consumption Use* in three lakes.

With the above qualifications for the individual use assessments of lake resources in the Housatonic River Watershed, approximately 79% of the surveyed surface acreage of lakes is impaired (Table 6).

Table 6. Status of Housatonic River Basin lakes surveyed in summer 1997.

LAKE	LOCATION	SIZE (Acres)	TROPHIC STATE	USE ASSESSMENT (Acres)	IMPAIRMENT CAUSE(S)
Ashley Lake **	Washington	111	U	2° Contact-F(111) Aesthetics-F(111)	NA
Ashmere Lake	Hinsdale	217	U	Aquatic Life-P(217) 2° Contact-F(217) Aesthetics-F(217)	Non-native plants (Ms)
Lake Averic **	Stockbridge	38	U	Aquatic Life-P(38) 2° Contact-F(38) Aesthetics-F(38)	Non-native plants (Ms)
Benedict Pond (DEM, '95)	Great Barrington/ Monterey	35	M	2° Contact-F(35) Aesthetics-F(35)	NA
Lake Buel	Monterey/ New Marlborough	194	E	Aquatic Life- P(194) 2° Contact-F(194) Aesthetics-F(194)	Non-native plants (Ms, Nm)
Center Pond	Dalton	30	U	Fish Consumption-N(30)	Priority organics (PCB)
Cleveland Brook Reservoir **	Hinsdale	145	U	2° Contact-F(145) Aesthetics-F(145)	NA
Cookson Pond	New Marlborough	67	U	2° Contact-F(67) Aesthetics-F(67)	NA
Crane Lake	West Stockbridge	28	U	1° Contact-N(7);U(21) 2° Contact-F(21);N(7) Aesthetics-F(21);N(7)	Noxious plants
Farnham Reservoir **	Washington	42	U	2° Contact-F(42) Aesthetics-F(42)	NA
Lake Garfield	Monterey	262	U	2° Contact-F(262) Aesthetics-F(262)	NA
Goose Pond	Lee/ Tyringham	225	M	Aquatic Life-P(225) 2° Contact-F(225) Aesthetics-F(225)	Non-native plants (Ms, Pc; Fugro East, Inc., '95)
Greenwater Lake	Becket	88	U	Aquatic Life-P(88) 2° Contact-F(88) Aesthetics-F(88)	Non-native plants (Ms)
Hayes Pond	Otis	53	U	2° Contact-F(53) Aesthetics-F(53)	NA
Laurel Lake	Lee/ Lenox	165	E	Aquatic Life-P(165) 2° Contact-F(165) Aesthetics-F(165)	Non-native plants (Ms, Nm)
Long Pond **	Great Barrington	113	E	Aquatic Life-P(113) 1° Contact-N(6);U(107) 2° Contact-F(107);N(6) Aesthetics-F(107);N(6)	Non-native plants (Ms) Noxious plants
Mansfield Pond	Great Barrington	25	E	Aquatic Life-P(25) 1° Contact-N(15);U(10) 2° Contact-F(10);N(15) Aesthetics-F(10);N(15)	Non-native plants (Ms, Pc) Noxious plants
Mill Pond	Egremont	20	E	1° Contact-N(20) 2° Contact-N(20) Aesthetics-N(20)	Noxious plants
Mill Pond	Sheffield	107	E	1° Contact-N(107) 2° Contact-N(107) Aesthetics-N(107)	Noxious plants
Onota Lake	Pittsfield/ Richmond	617	M	Aquatic Life-P(617) 2° Contact-F(617) Aesthetics-F(617)	Non-native plants (Ms, Nm, Pc)
Plunkett Reservoir	Hinsdale	73	U	Aquatic Life-P(73) 2° Contact-F(73) Aesthetics-F(73)	Non-native plants (Ms, Nm)

** Indicates Class A (water supply) waterbody; all others are Class B.
INFORMATION CODES: **Trophic State**-- E= Eutrophic, M= Mesotrophic, U= Undetermined.
Use Attainment-- F= Full support, N= Non-support, P= Partial support, U= Undetermined.
Non-native Plants-- Ms= *Myriophyllum spicatum*, Nm= *Najas minor*, Pc= *Potamogeton crispus*.

Table 6 (continued). Status of Housatonic River Basin lakes surveyed in summer 1997.

LAKE	LOCATION	SIZE (Acres)	TROPHIC STATE	USE ASSESSMENT (Acres)	IMPAIRMENT CAUSE(S)
Pontoosuc Lake	Pittsfield/ Lanesborough	467	U	Aquatic Life-P(467) Fish Consumption-N(467) 2° Contact-F(467) Aesthetics-F(467)	Metals (Hg) Non-native plants (Ms, Nm, Pc)
Prospect Lake	Egremont	55	M	2° Contact-F(55) Aesthetics-F(55)	NA
Richmond Pond	Pittsfield/ Richmond	218	U	Aquatic Life-P(218) 2° Contact-F(218) Aesthetics-F(218)	Non-native plants (Ms, Nm)
Risingdale Impoundment	Great Barrington	43	U	Fish Consumption-N(43)	Priority organics (PCB)
Stevens Pond	Monterey	30	U	2° Contact-F(30) Aesthetics-F(30)	NA
Stockbridge Bowl	Stockbridge	382	E	Aquatic Life-P(382) 2° Contact-F(382) Aesthetics-F(382)	Non-native plants (Ms)
Thousand Acre Swamp Pond	New Marlborough	155	E	Aquatic Life-P(155) 1° Contact-N(75);U(80) 2° Contact-F(80);N(75) Aesthetics-F(80);N(75)	Non-native plants (Ms) Noxious plants
Upper Goose Pond	Lee/ Tyringham	45	M	Aquatic Life-P(45) 2° Contact-F(45) Aesthetics-F(45)	Non-native plants (Ms)
Upper Sackett Reservoir **	Hinsdale	20	U	2° Contact-F(20) Aesthetics-F(20)	NA
Windsor Reservoir **	Hinsdale/ Windsor	62	M	2° Contact-F(62) Aesthetics-F(62)	NA
Woods Pond	Lee/ Lenox	122	E	Fish Consumption-N(122) 1° Contact-P(61);N(61) 2° Contact-P(61);N(61) Aesthetics-P(61);N(61)	Noxious plants Priority organics (PCB) Turbidity

** Indicates Class A (water supply) waterbody; all others are Class B.

INFORMATION CODES: **Trophic State**-- E= Eutrophic, M= Mesotrophic, U= Undetermined.
Use Attainment-- F= Full support, N= Non-support, P= Partial support, U= Undetermined.
Non-native Plants-- Ms= *Myriophyllum spicatum*, Nm= *Najas minor*, Pc= *Potamogeton crispus*.

RECOMMENDATIONS - LAKES

- The DPH fish consumption advisory to eat no fish, frogs and turtles from the Housatonic River from Dalton to Sheffield because of PCB contamination results in the *Fish Consumption Use* being assessed as non-support in Center Pond. Whether or not the biota in the East Branch Housatonic River (including Center Pond) upstream of the Crane & Co., Inc. dams (which pose a barrier to fish migration) are contaminated by PCB is currently being investigated by EPA as part of their Ecological Risk Assessment. The DPH should review the results of this investigation and adjust the fish consumption advisory as needed.

- Continue to monitor the effectiveness of the GE Company Pittsfield PCB cleanup activities as they pertain to impoundments of the mainstem Housatonic River. Document these results in a comprehensive report including data and analyses.

- EPA is in the process of collecting additional data on streambed sediments and river bank soils from Dalton through Sheffield, although this data is not yet available (expected sometime in 2000). EPA has also been collecting considerable data (sampling in 1998 and 1999) on river biota at a variety of trophic levels (including fish, frogs, and ducks) as part of their Ecological Risk Assessment. Additional data may also be collected in 2000. Review and evaluate these data as they pertain to impoundments of the mainstem Housatonic River.

RECOMMENDATIONS (CONTINUED) – LAKES

- For non-native aquatic or wetland plant species that were isolated to one or a few location(s) quick action is advisable to manage these populations in order to alleviate the need for costly and potentially fruitless efforts to do so in the future. Two courses of action should be pursued concurrently. More extensive surveys need to be conducted, particularly downstream from these recorded locations, to determine the extent of the infestation. And, "spot" treatments should be undertaken to control populations at these sites before they spread further. These treatments may be in the form of carefully hand pulling individual plants, in small areas, or selective herbicide applications in larger areas. In either case, the treatments should be undertaken prior to fruit formation and with a minimum of fragmentation of the individual plants. These cautions will minimize the spreading of the populations.

- The aquatic species *Myriophyllum spicatum*, *Najas minor*, and *Potamogeton crispus* and the wetland species *Lythrum Salicaria* and *Phragmites australis* have become more wide-spread in the Housatonic River Watershed lakes and wetlands. Accordingly these species will require an extensive program aimed at 1) determining the extent of the distribution, 2) reducing impairment, and 3) controlling further spreading to unaffected waterbodies.

- As with the isolated cases, a program to manage the more extensive plant infestations should include additional monitoring efforts to determine the extent of the problem. Plant control aspects of any plan to manage the non-native aquatic species mentioned above can select from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.), each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should be discouraged because of the propensity for these plants to reproduce and spread vegetatively (from cuttings).

- Another important component of a management plan is prevention of further spreading of these plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations occurring in unaffected areas and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and responsibility of spreading these species.

- Diagnostic/feasibility (D/F) studies have been conducted on five lakes in the Housatonic River Basin. These include: Onota Lake in Pittsfield, Richmond Pond in Richmond, Stockbridge Bowl in Stockbridge, Prospect Lake in Egremont, and Mansfield Lake in Great Barrington. Another D/F study has recently been completed for Pontoosuc Lake in Pittsfield/Lanesborough (Project # 97-01/314) (ENSR 1999). Each of these studies has recommendations to deal with watershed and in-lake issues specific to the waterbody. Whether or not the recommendations have been implemented is unknown, although they should still be applicable and merit implementation. Two projects are currently underway in the Housatonic River Basin (MA DEP 2000a):

  Pontoosuc Lake Watershed Resource Restoration (Project # 99-03-319). This project will improve water quality in Pontoosuc Lake by beginning implementation of the recommendations of the D/F Study, specifically, the installation of stormwater BMPs.

  Implementing the Diagnostic/Feasibility Study Recommendations for Onota Lake (Project # 00-01-319). This project will implement in-lake and watershed management measures recommended in a comprehensive Diagnostic/Feasibility Study prepared by International Technology Corporation for Onota Lake, specifically installation of a large culvert to improve circulation and improve water quality.

- Coordinate with DEM to generate quality assured lakes data and conduct more intensive lake surveys to better determine the lake trophic and use support status and identify causes and sources of impairment.

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APPENDIX A

INTRODUCTION

Quality Assurance/Quality Control (QA/QC) activities were conducted as part of the DEP DWM Housatonic River Watershed Monitoring Survey in 1997/98. This QA/QC review was conducted to ensure that the collection and analysis of the monitoring data was of high quality. The 1997/98 monitoring data subjected to this QA/QC review includes the following: discrete water samples, fish tissue samples and *in-situ* water quality measurements. All discrete water sample and fish tissue monitoring data were reviewed independently by the Wall Experiment Station's (WES) Quality Assurance Program and the Division of Watershed Management's (DWM) Quality Assurance Officer and Assessment Coordinator. All *in-situ* water quality measurements were reviewed independently by DWM's Hydrolab® Instrument Coordinator and Database Manager. Data that fell outside established QA/QC acceptance criteria were investigated and may have been subject to censoring. This Quality Assurance/Quality Control appendix is divided into three sections: A.1 field and laboratory data objectives; A.2 QA/QC data; A.3 analytical methods.

A.1 Field and Laboratory QA/QC Objectives

Data collected by DWM in the 1997/98 Housatonic River survey was subject to field and laboratory data quality objectives. Section A.1.1 outlines the field collection objectives and laboratory quality control for discrete water samples. Section A.1.2 includes fish tissue laboratory quality control methods and Section A.1.3 includes Hydrolab QA/QC procedures.

A.1.1 Discrete Water Sample Data

FIELD

The collection of discrete water sample analytes followed DWM Standard Operating Procedures[1,2]. Four field collection quality control criteria were applied to the Housatonic River Watershed 1997/98 discrete water sample data:

1.0 Sampling/Analysis Holding Time: Each analyte has a standard holding time that has been established to ensure sample/analysis integrity. Refer to DWM Standard Operating Procedure Table 1.0 CN# 1.1 [2] for a complete listing. If the standard holding time was exceeded, this objective is violated.

2.0 Quality Control Sample Frequency: At a minimum, one field blank and one replicate must be collected for every ten samples by any given sampling crew on any given date. If less than one quality control sample per 10 field samples was collected, this objective is violated.

3.0 Field Blank: Field blanks were prepared at the DWM Worcester Office. Reagent grade water was transported into the field where it was transferred into a sample container and fixed using the same method as its corresponding field sample. All blanks were submitted to WES laboratory "blind". If the field blanks were significantly different (>2 standard deviations [9]) from the detection limit, this data quality objective is violated.

4.0 Field Replicate: Two independent samples were collected from the same location and as close as possible to the same time in the field. Both samples were submitted to WES laboratory "blind". In order for this data quality objective to be met, the results must be:

<20% Relative Percent Difference (RPD) for method detection limits >1mg/L
<30% RPD for method detection limits <1mg/L

A detailed QA/QC summary of the four data quality objectives and additional DWM quality assurance observations for the 1997/98 Housatonic River Watershed data can be found in the 1997/98 Watershed QA/QC Assessment Report [8].

LABORATORY

Discrete water sample analysis followed EPA-approved laboratory QA/QC methodologies in accordance with WES Standard Operating Procedures [3]. The quality of data generated at WES was determined by analyzing the results of a variety of quality control procedures including but not limited to:

Low Calibration Standards – Checks the stability of the instrument's calibration curve. Analyzes the accuracy of an instrument's calibration within a 5% range.

Reference Standards – Generally, a second source standard (a standard different from the calibration stock standard) that analyzes the accuracy of an instrument's calibration within a 5% range.

Laboratory Reagent Blank/Method Blank (LRB) – Reagent grade water (de-ionized) extracted with every sample set to ensure that the system is free of target analytes (< MDL).

Duplicate Sample – Measures the precision (% Relative Percent Difference) of the extraction and analytical process. The acceptable laboratory %RPD range is typically ≤ 25%.

Spike Sample (Laboratory Fortified Blank - LFB, Laboratory Fortified Matrix - LFM)– Measures the accuracy (% Recovery) of an analytical method. The acceptable laboratory % recovery range is typically between 80 – 120% for LFB samples and 70 –130% for LFM discrete water samples.

The WES Laboratory is solely responsible for the administration of its Quality Assurance Program and Standard Operating Procedures. The frequency of the laboratory's quality control procedure was at times inconsistent with their Quality Assurance Plan [3]. In these circumstances additional quality assurance procedures were used. Refer to WES's Quality Assurance Plan [3] for specific laboratory analytical QA/QC criteria. WES laboratory releases discrete water sample data when their established QA/QC criteria are met or the data are labeled as outside of these criteria.

A.1.2 Fish Tissue Data

Fish were collected and processed according to DWM's Quality Assurance Project Plan [4]. Tissue preparation and analysis strictly adhered to EPA-approved laboratory QA/QC methodologies in accordance with WES Standard Operating Procedures [6,7]. The quality of tissue data generated at WES was determined by incorporating a variety of quality control samples:

Laboratory Reagent Blank/Method Blank (LRB) – Clean clam tissue matrix extracted with every sample set to ensure that the system is free of target analytes (< MDL).

Laboratory Fortified Blank (LFB) – Clean clam tissue matrix spiked with a low concentration of target compounds. LFB results are used to establish accuracy of system's performance. The acceptable laboratory % recovery range is typically 80 – 120%.

Laboratory Fortified Matrix (LFM) – Tissue matrix spiked with a low concentration of a target compound. LFM results are used to establish accuracy of the extraction and analytical process. The acceptable laboratory % recovery range is typically between 70 – 130% for metal analysis and 60 –140% for PCB/Organochlorine Pesticide analysis

Quality Control Standard (QCS) – A pre-spiked secondary tissue sample. QCS results are used to establish accuracy in the extraction and test methods. The acceptable laboratory % recovery range is typically between 80–120%.

The WES Laboratory is solely responsible for the administration of its Quality Assurance Program and Standard Operating Procedures. The frequency of the laboratory's quality control procedure was at times inconsistent with their Quality Assurance Plan [3]. In these circumstances additional quality assurance procedures were used. Refer to WES's Quality Assurance Plan [3] for specific laboratory analytical QA/QC criteria. WES laboratory releases tissue data when their established QA/QC criteria are met or the data are labeled as outside of these criteria.

A.1.3 *In-situ* Water Quality Analysis

Trained DWM staff members conducted *in-situ* measurements using a Hydrolab® Multiprobe Series 3 analyzer. The Hydrolab® Multiprobe Series 3 analyzer measures dissolved oxygen, temperature, pH, conductivity, depth and turbidity and calculates total dissolved solids and % saturation of oxygen. To ensure the quality of the *in-situ* data, the following QA/QC steps were taken:

1.0 Pre-Calibration: After each analytical probe on the Hydrolab® analyzer was calibrated, a pre-calibration check was conducted. A low ionic standard was first analyzed to check the accuracy of the instrument. Then an instrument check consisting of de-ionized water was analyzed to check the instrument for contamination. The instrument check criteria is based on de-ionized water that that had been stored and vented to the air for at least three days. If the pre-calibration check achieved the criteria in Table A.1-1 then the instrument was ready for field analysis but if the pre-calibration check failed to achieve the low ionic standard criteria than the instrument was re-calibrated and a second low ionic and instrument check was analyzed. If the instrument failed to meet the established low ionic standard criteria a second time the Hydrolab® instrument could not be used to collect data and maintenance was scheduled. Refer to the DWM Hydrolab® Standard Operating Procedure [5].

2.0 Post Survey Check: Once the Hydrolab® was returned from field sampling, a post survey check was performed to ensure that no malfunction or damage had occurred to any of the Hydrolab® probes. The low ionic standard and the instrument check were re-analyzed. If the post survey check achieved the established criteria in Table A.1-1, the data was deemed acceptable and was ready for the data reduction QA/QC step. If, however, the post calibration failed to meet the criteria, the Hydrolab® Coordinator investigated the cause and recommended censoring of affected data to the Database Manager.

3.0 Data Reduction: The Hydrolab® Coordinator and Database Manager reviewed the Hydrolab® data for instability, instrument malfunction, operator technique and aberrant trends. If any of these conditions were detected, the data was investigated and may have been recommended for censoring. The Database Manager electronically tagged all data recommended for censoring in the database.

Table A.1-1 Hydrolab® Multiprobe Series 3 analyzer pre and post calibration specifications.

Hydrolab® Analyte	**Low-Ionic Standard**	**Instrument Check ***
Dissolved Oxygen	Saturation Chart (dependant on temperature & barometric pressure)	
pH	6.90 ±1%	5.6 ±0.2 units
Specific Conductance	74 ±1%	1.0 ±1%
Turbidity	0.0 ±5%	0.0 ±5%
Temperature	Ambient ±0.15°C**	Ambient ±0.15°C**
Depth	Field Calibrated ±0.45m	Field Calibrated ±0.45m
Salinity	Not Applicable	0.0 ±0.2ppt
Redox	Not Applicable	0.0±20mV

* Based on Division of Watershed Management's filtered de-ionized water

** Compared to the DWM laboratory's wall thermometer

REFERENCES

(1) MA DEP. 1999. CN 1.0 Grab Collection Techniques for DWM Water Quality Sampling *1999.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

(2) MA DEP. 1999. CN 1.1 Sampling Analytes Table 1.0, *1999.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

(3) MA DEP. 1995. Laboratory Quality Assurance Plan and Standard Operating Procedures, Appendix B and C. January *1995.* Massachusetts Department of Environmental Protection, Division of Environmental Analysis, Senator William X. Wall Experiment Station. Lawrence MA.

(4) MA DEP. 1999. CN 13.0 Fish Contaminant Monitoring Program Quality Assurance Project Plan, *1999.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

(5) MA DEP. 1999. CN 4.0 Hydrolab® Multiprobe Series 3 and Appendixes CN 4.1 – 4.5, *1999.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

(6) MA DEP. 1995. Laboratory Quality Assurance and Standard Operating Procedures, "Wet Tissue Digestion for Metals Analysis by Atomic Absorption Spectroscopy and/or ICP Emission Spectroscopy (Fish, Clams, Mussels, Etc.)", January *1995.* Massachusetts Department of Environmental Protection, Division of Environmental Analysis, Senator William X. Wall Experiment Station. Lawrence MA.

(7) MA DEP. 1995. Laboratory Quality Assurance and Standard Operating Procedures, AOAC Method 983.21 "PCBs and Organochlorine Pesticides in Biological Tissue", January *1995.* Massachusetts Department of Environmental Protection, Division of Environmental Analysis, Senator William X. Wall Experiment Station. Lawrence MA.

(8) MA DEP. 1999. CN 9.0 1997/98 Watershed QA/QC Assessment Report , *1999.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

(9) Standard Methods for the Examination of Water and Wastewater, 20th Edition, Section 1010B "Statistics", pg. 1-2 and 1-3.

A.2 QA/QC Data

Field blank and replicate sampling results for the discrete water quality sampling (physico/chemical and bacteriological) are provided in Tables A.2-1 through A.2-4. Tables A.2-5 and A.2-6 contain laboratory QA/QC data for organics in tissue analyses and metals in tissue analyses, respectively.

Table A.2-1. 1997/1998 DEP DWM Housatonic River Basin instream physico-chemical QA/QC field blank data. (All units expressed in mg/L unless otherwise specified.)

	Time (24hr)	Alkalinity	Hardness	Specific Conductivity (umhos)	Chloride	Suspended Solids	Total Solids	Turbidity (NTU)	Total Kjeldahl Nitrogen	Ammonia	Nitrate	Total Phosphorus
Field Blank Sample												
21-0002 BLANK 07/22/97	9:50	2.0	<0.66	--	<1.0	**	--	0.10	--	<0.02	<0.02	<0.01
21-0029 BLANK 08/26/97	10:45	--	--	--	--	--	--	--	--	--	--	--
21-0026 BLANK 08/26/97	11:57	2.0	**	--	1.0	<2.5	--	<0.1	--	<0.02	<0.02	<0.01
21-0046 BLANK 09/30/97	**	--	--	--	--	--	--	--	--	--	--	--
21-0038 BLANK 09/30/97	10:05	2.0	<0.66	--	<1.0	<2.5	--	**	--	<0.02	<0.02	<0.01
21-0055 BLANK 10/29/97	**	1.0	**	--	<1.0	<2.5	--	**	--	<0.02	<0.02	<0.01

* = interference ** = missing/censored data -- = no data

Table A.2-2. 1997/1998 DEP DWM Housatonic River Basin instream physico-chemical QA/QC field replicate data. (All units expressed in mg/L unless otherwise specified.)

	Time (24hr)	Alkalinity	Hardness	Specific Conductivity (umhos)	Chloride	Suspended Solids	Total Solids	Turbidity (NTU)	Total Kjeldahl Nitrogen	Ammonia	Nitrate	Total Phosphorus
KONKAPOT RIVER, Station: KR12												
21-0013 21-0014 07/22/97	12:45	43	47	--	7.0	**	--	1.1	--	<0.02	0.02	0.02
21-0014 21-0013 07/22/97	12:45	43	46	--	7.0	**	--	1.1	--	<0.02	0.02	0.02
Relative Percent Difference (RPD):		*0.0%*	*2.2%*		*0.0%*			*0.0%*		*0.0%*	*0.0%*	*0.0%*
KONKAPOT RIVER, Station: KR07												
21-0020 21-0021 08/26/97	10:04	118	**	--	9.0	<2.5	--	0.60	--	<0.02	0.09	<0.01
21-0021 21-0020 08/26/97	10:04	118	**	--	10	<2.5	--	0.60	--	<0.02	0.09	<0.01
Relative Percent Difference (RPD):		*0.0%*			*10.5%*	*0.0%*		*0.0%*		*0.0%*	*0.0%*	*0.0%*
21-0052 21-0053 10/29/97	10:46	78	**	--	7.0	<2.5	--	**	--	0.02	<0.02	0.03
21-0053 21-0052 10/29/97	10:46	79	**	--	7.0	<2.5	--	**	--	<0.02	<0.02	<0.01
Relative Percent Difference (RPD):		*1.3%*			*0.0%*	*0.0%*				*0.0%*	*0.0%*	*100.0%*
KONKAPOT RIVER, Station: KR01												
21-0035 21-0036 09/30/97	9:15	161	204	--	9.0	2.6	--	**	--	<0.02	0.49	0.02
21-0036 21-0035 09/30/97	9:15	159	202	--	9.0	<2.5	--	**	--	<0.02	0.53	0.02
Relative Percent Difference (RPD):		*1.3%*	*1.0%*		*0.0%*	*3.9%*				*0.0%*	*7.8%*	*0.0%*

* = interference ** = missing/censored data -- = no data

Table A.2-3. 1997/1998 DEP DWM Housatonic River Basin instream bacteriological QA/QC field blank data. (cfu/100mLs.)

			Time (24hr)	FECAL	E-COLI	ENTEROCOCCUS	AEROMONAS
Field Blank Sample							
21-0002	BLANK	07/22/97	9:50	**	--	--	--
21-0029	BLANK	08/26/97	10:45	<20	<20	--	--
21-0026	BLANK	08/26/97	11:57	<20	<20	--	--
21-0046	BLANK	09/30/97	**	<20	<20	--	--
21-0038	BLANK	09/30/97	10:05	<20	<20	--	--
21-0055	BLANK	10/29/97	**	<20	<20	--	--
21-0062	BLANK	10/29/97	**	<20	<20	--	--
21-0081	BLANK	05/19/98	11:15	<20	<20	<20	--
21-0110	BLANK	06/02/98	10:10	**	**	**	--

* = interference ** = missing/censored data -- = no data

Table A.2-4. 1997/1998 DEP DWM Housatonic River Basin instream bacteriological QA/QC field replicate data. (cfu/100mLs, log10 transformed.)

			Time (24hr)	FECAL	E-COLI	ENTEROCOCCUS	AEROMONAS
KONKAPOT RIVER, Station: KR12							
21-0013	21-0014	07/22/97	12:45	**	--	--	--
21-0014	21-0013	07/22/97	12:45	**	--	--	--
KONKAPOT RIVER, Station: KR08							
21-0049	21-0050	09/30/97	12:54	2.079	1.778	--	--
21-0050	21-0049	09/30/97	12:54	2.146	1.778	--	--
Relative Percent Difference (RPD):				*3.2%*	*0.0%*		
KONKAPOT RIVER, Station: KR07A							
21-0079	21-0080	05/19/98	11:15	<1.301	<1.301	1.778	--
21-0080	21-0079	05/19/98	11:15	<1.301	<1.301	<1.301	--
Relative Percent Difference (RPD):				*0.0%*	*0.0%*	*31.0%*	
21-0108	21-0109	06/02/98	10:05	**	**	**	--
21-0109	21-0108	06/02/98	10:05	**	**	**	--
KONKAPOT RIVER, Station: KR07							
21-0020	21-0021	08/26/97	10:04	1.602	1.301	--	--
21-0021	21-0020	08/26/97	10:04	1.778	<1.301	--	--
Relative Percent Difference (RPD):				*10.4%*	*0.0%*		
21-0052	21-0053	10/29/97	10:46	<1.301	<1.301	--	--
21-0053	21-0052	10/29/97	10:46	*	<1.301	--	--
Relative Percent Difference (RPD):					*0.0%*		
KONKAPOT RIVER, Station: KR06							
21-0032	21-0033	08/26/97	11:57	1.602	<1.301	--	--
21-0033	21-0032	08/26/97	11:57	1.301	<1.301	--	--
Relative Percent Difference (RPD):				*20.7%*	*0.0%*		
KONKAPOT RIVER, Station: KR05							
21-0059	21-0060	10/29/97	9:27	1.301	<1.301	--	--
21-0060	21-0059	10/29/97	9:27	*	<1.301	--	--
Relative Percent Difference (RPD):					*0.0%*		
KONKAPOT RIVER, Station: KR01							
21-0035	21-0036	09/30/97	9:15	2.806	3.000	--	--
21-0036	21-0035	09/30/97	9:15	2.820	<1.301	--	--
Relative Percent Difference (RPD):				*0.5%*	*79.0%*		

* = interference ** = missing/censored data -- = no data

Table A.2-5. 1997/1998 DEP DWM Housatonic River Basin Survey laboratory QA/QC data for organics in tissue analyses. (Data expressed in µg/g wet weight unless otherwise noted.)

ANALYTE	ACCURACY					MINIMUM DETECTION LIMIT
	Blank #3 (6/1 - 9/29/98)	Blank #4 (6/4 - 9/29/98)	Lab Spike #2 (6/2 - 9/29/98)			
% Lipid	0.21	0.45	0.38			
			EXPECTED	LFM	RECOVERY (%)	
PCB A1242	*	*	2.5	2.9	116	0.06
PCB A1254	*	*	*	*	*	0.17
PCB A1260	*	*	*	*	*	0.16
Chlordane	*	*	*	*	*	0.11
Toxaphene	*	*	*	*	*	0.11
a-BHC	*	*	*	*	*	0.0062
b-BHC	*	*	*	*	*	0.0019
Lindane	*	*	*	*	*	0.0059
d-BHC	*	*	*	*	*	0.020
Hexachlorocyclopentadiene	*	*	*	*	*	0.0077
Trifluralin	*	*	*	*	*	0.0062
Hexachlorobenzene	*	*	*	*	*	0.0091
Heptachlor	*	*	*	*	*	0.012
Heptachlor Epoxide	*	*	*	*	*	0.030
Methoxychlor	*	*	*	*	*	1.07
DDD	*	*	*	*	*	0.0052
DDE	*	*	*	*	*	0.015
DDT	*	*	*	*	*	0.0083
Aldrin	*	*	*	*	*	0.0075

LFM - Laboratory Fortified Matrix

* not detected or the analytical result is at or below the established minimum detection limit (MDL).

REMARKS: The samples were extracted and analyzed according to the modified AOAC 983.21 procedure for the analysis of PCBs and Organochlorine Pesticides.

Table A.2-6. 1997/1998 Housatonic River Basin Survey laboratory QA/QC data for metals in tissue analyses. (Data expressed in mg/kg wet weight unless otherwise noted.)

Sample ID	Analyte	Precision			Accuracy			Accuracy* (% Recovery)		MDL	Analytical Method
		Sample	Duplicate	RPD	LFM	Spike Amount	Recovery (%)	LFB	QCS		
97-3118	As	<MDL	<MDL	NA	1.86	2.30	81	92	91	0.040	EPA 200.9
97-3118	Pb	<MDL	<MDL	NA	19.3	23.0	84	93	98	0.140	EPA 200.7
97-3118	Se	0.214	0.210	1.9%	2.12	2.30	92	103	84	0.040	EPA 200.9
97-3118	Cd	<MDL	<MDL	NA	22.5	23.0	98	102	93	0.020	EPA 200.7
97-3118	Hg	0.360	0.460	24.4%	0.38	0.46	84	97	112	0.020	EPA 245.6
97-4001	As	<MDL	<MDL	NA	1.80	2.0	90	101	92	0.040	EPA 200.9
97-4001	Pb	<MDL	<MDL	NA	2.30	2.0	115	90	**	0.140	EPA 200.7
97-4001	Se	0.147	0.139	5.6%	2.34	2.0	117	114	94	0.040	EPA 200.9
97-4001	Cd	<MDL	<MDL	NA	2.20	2.0	110	90	85	0.020	EPA 200.7
97-4003	Hg	0.126	0.143	12.6%	0.110	0.125	88	105	112	0.010	EPA 245.6

LFB - Laboratory Fortified Blank
LFM - Laboratory Fortified Matrix
MDL - Minimum Detection Limit
NA - Not Applicable
QCS - Quality Control Sample
RPD - Relative Percent Difference
*see Appendix A section A.1.2. for further details
** target compound not spiked

A.3 Analytical Methods

Discrete Water Sample Analytes	EPA Method*	SM Methods**	Other Methods
Fecal Coliform		SM 9222D	
E. Coli, MTEC		SM 9213D	
Enterococcus		SM 9230C	
Alkalinity (titrimetric)	EPA 310.1	SM 2320B	
Chloride (titrimetric)		SM 4500CL⁻B	
Hardness (EDTA)	EPA 130.2	SM 2340B	
Turbidity	EPA 180.1	SM 2130B	
Ammonia-N (Automated – phenate)	EPA 350.1	SM 4500-NH_3-H	
Nitrate/Nitrite-N (automated – hydrazine)	EPA 353.1	SM 4500 –NO_3 -H	
Total Phosphorus	EPA 365.2	SM 4500P-E	
Suspended Solids		SM 2540D	
Fish Tissue Analytes			
PCB Arochlor 1242			AOAC 983.21***
PCB Arochlor 1254			"
PCB Arochlor 1260			"
Chlordane			"
Toxaphene			"
a-BHC			"
b-BHC			"
Lindane			"
d-BHC			"
Hexachlorocyclopentadiene			"
Trifluralin			"
Hexachlorobenzene			"
Heptachlor			"
Heptachlor Epoxide			"
Methoxychlor			"
DDD			"
DDE			"
DDT			"
Aldrin			"
Arsenic (STGFAA)	EPA 200.9	SM 3113	
Lead (ICP)	EPA 200.7	SM 3120B	
Selenium (STGFAA)	EPA 200.9	SM 3113	
Cadmium (ICP)	EPA 200.7	SM 3120B	
Mercury (cold vapor)	EPA 245.1	SM 3112B	

* = "Methods for Chemical Analysis of Water and Wastes", Environmental Protection Agency, Environmental Monitoring Systems Laboratory – Cincinnati (EMSL-CI), EPA-600/4-79-020, Revised March 1983 and 1979 where applicable.
** = Standard Methods, Examination of Water and Wastewater, 20th edition
***= PCBs and Organochlorine Pesticides in Biological Tissue, AOAC Official Methods of Analysis, 1990

APPENDIX B - 1997 DEP HOUSATONIC RIVER BASIN SURVEY DATA

MATERIALS AND METHODS

The DWM began sampling in July 1997 and continued through June 1998. The DWM sampling plan matrix is summarized in Table B1. Sampling components at river stations included *in situ* measurements, physico-chemical and nutrient sampling, fecal coliform bacteria sampling, benthic macroinvertebrate sampling, fish population, toxics in fish flesh and sediment. Synoptic surveys of lakes were conducted during August 1997 to coincide with the maximum extent of macrophyte growth. Each sampling component is described in the sections that follow.

Table B1. 1997 Housatonic Basin Survey DEP DWM sampling matrix.

STREAM NAMES	STATION[1]	1997 JULY	1997 AUG	1997 SEPT	1997 OCT	1998 MAY	1998 JUNE
Southwest Branch Housatonic River	HW02S		M		M		
West Branch Housatonic River	HW01		M		M		
East Branch Housatonic River	21-EBH01		M*		M*		
	21-EBH02		M*		M*		
Housatonic River	21-HR01		M*		M*		
	21-HR02		M*		M*		
	21-HR03		M				
	21-HR04		M				
	21-HR05		M				
	21-HR06		M				
Furnace Brook	FB01		M				
Williams River	WR01		M				
Karner Brook	KB01		M, P				
	KB02		M, P				
Konkapot River	KR12	B, H, N, C	B, H, N, C, M	B, H, N, C	B, H, N, C		
	KR11	B, H	B, H, M	B, H	B, H		
	KR10	B, H	B, H	B, H	B, H		
	F0049				F		
	KR09	B, H	B, H, M	B, H	B, H		
	KR08	B, H	B, H, M	B, H	B, H		
	KR07A					B, S	B
	KR07	B, H, N, C	B, H, N, C	B, H, N, C	B, H, N, C	B	B
	(KR07) bio or F0048		M		F		
	KR06	B, H	B, H, M	B, H	B, H	B	B
	KR05	B, H	B, H, M	B, H	B, H	B	B
	KR04	B, H	B, H	B, H	B, H	B	B
	KR03A					B	B
	F0047				F		
	KR03	B, H	B, H, M	B, H	B, H	B	B
	KR02A					B	B
	KR02	B, H	B, H, M	B, H	B, H	B	B
	KR01A					B	B
	KR01 or F0046	B, H, N, C	B, H, N, C, F	B, H, N, C	B, H, N, C	B, S	B
	(KR01) bio or F0045		M, F				
Umpachene River	KR06A					B	B
Squabble Brook	KR02B					B	B
	KR02C					B	

[1]Samping did not necessarily occur at the same exact location although that which occurred in the general vicinity of the sampling station is listed together.

B=Bacteria (fecal coliform, E. coli); C=Chemistry (alkalinity, hardness, chlorides, total suspended solids, turbidity); F=Fish toxics; H=Hydrolab™ multiprobe meter (pH, dissolved oxygen, conductivity, temperature, total dissolved solids); M=Macroinvertebrate kick sampling and habitat assessment; M* =Macroinvertebrate samples collected with Hester Dendy Samplers deployed in August and retrieved in October; N=Nutrients (total phosphorus, ammonia, nitrate-nitrogen, nitrite-nitrogen); P=Fish population; S=Sediment screening (grab samples analyzed for total solids, aluminum, iron and mercury content.

SURVEY CONDITIONS

Conditions prior to each survey were characterized by analyzing precipitation and streamflow data. One weather station precipitation gage, Stockbridge Station #109, was used to determine precipitation and weather conditions in the five days prior to and on the sampling dates. Data from this station was provided by the DEM Office of Water Resources (MA DEM 1998). Discharge (hereinafter referred to as streamflow) and duration data were obtained from two continuous USGS stream gages in the basin (see Figure B1), East Branch Housatonic River at Coltsville (01197000) and Housatonic River near Great Barrington (01197500). Streamflow statistics for the period-of-records for both gages are available from USGS. These data can be found in their *Water Resources Data for Massachusetts and Rhode Island, Water Year 1997 and 1998* reports (Socolow *et al.*, 1997 and 1998) and the *Gazetteer of Hydrologic Characteristics of Streams in Massachusetts—Housatonic River Basin* (Wandle and Lippert 1984). The period of record (POR) for the East Branch Housatonic River gage at Coltsville is from March 1936 to present while the Housatonic River at Great Barrington gage is from May 1913 to present.

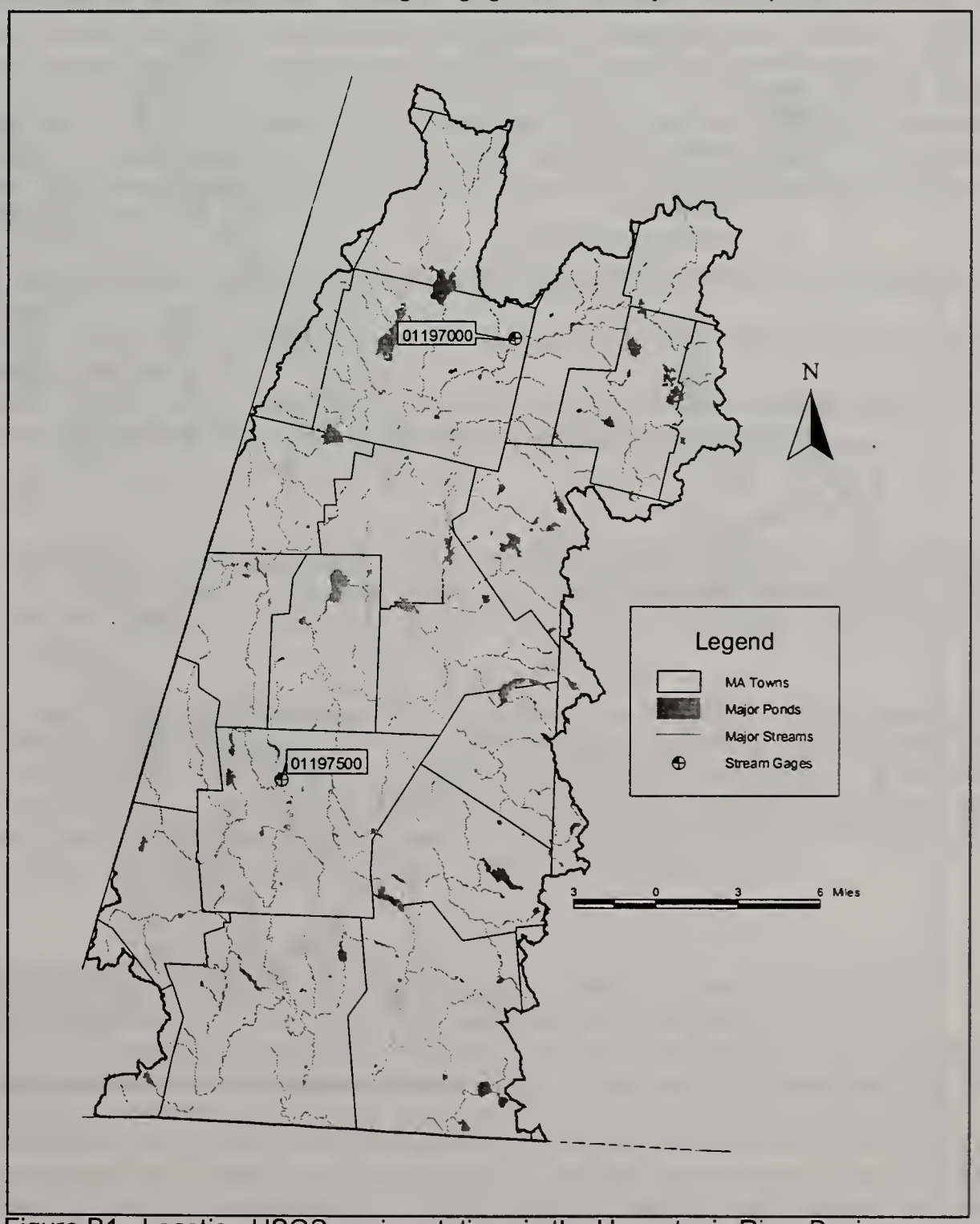

Figure B1. Location USGS gaging stations in the Housatonic River Basin.

STREAM WATER QUALITY MONITORING

The water quality sampling effort was focused on the Konkapot River and was comprised of a synoptic monitoring approach at the stations identified in Figure B2. Sampling at these synoptic monitoring locations included: *in situ* measurements at each station using a Scout 2 Hydrolab™ multiparameter meter (water temperature, dissolved oxygen, conductivity, total dissolved solids, and pH), and bacteria sampling (fecal coliform). Three sampling stations representing the upper, mid and lower watershed were also sampled for physico-chemical variables (alkalinity, hardness, specific conductivity, chloride, total and suspended solids, and turbidity), and nutrient concentrations (ammonia and nitrate nitrogen and total phosphorus). Investigative sampling to isolate sources of fecal coliform bacteria was conducted in the spring of 1998. These stations are also identified in Figure B2.

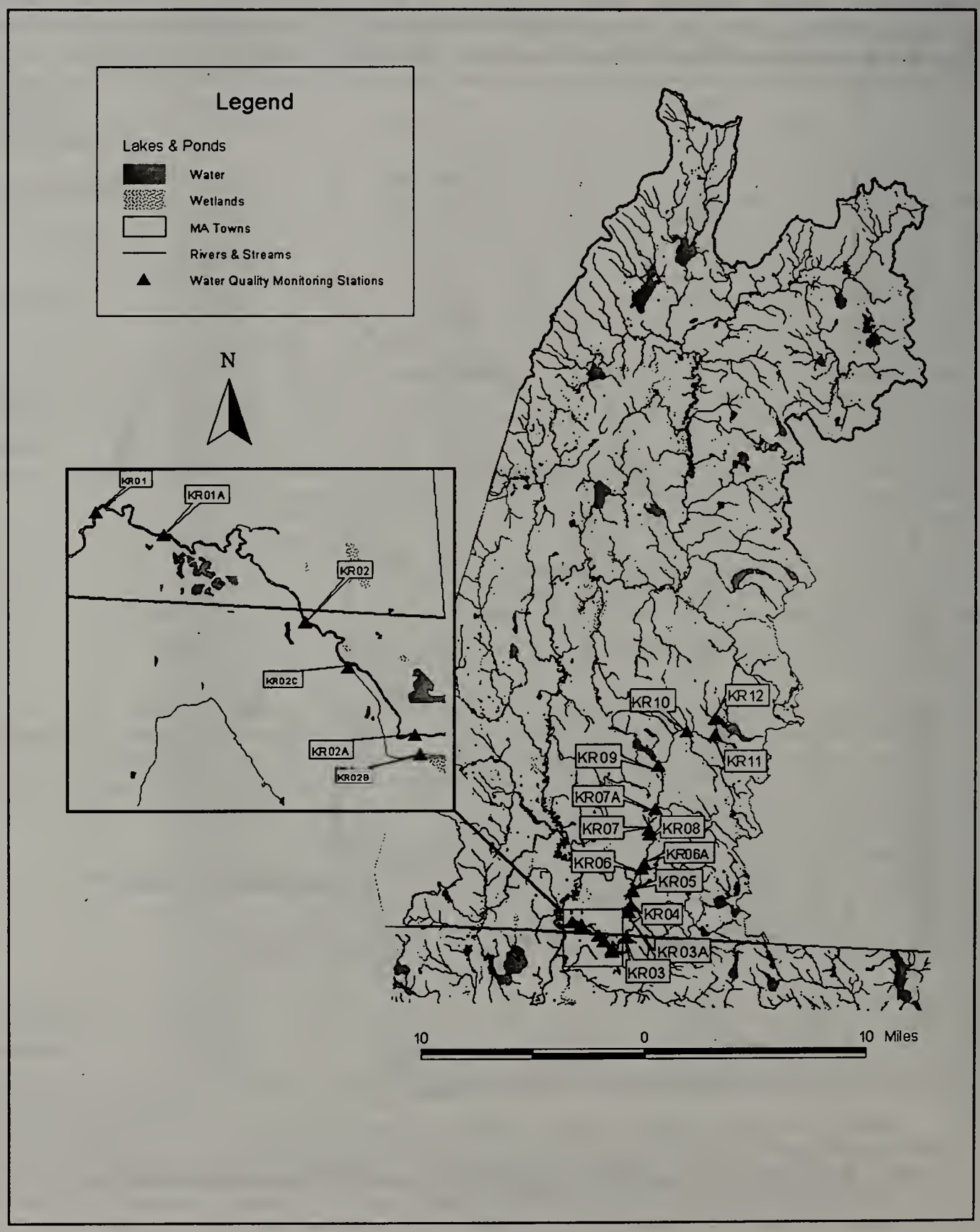

Figure B2. Location of 1997 water quality sampling stations in the Housatonic River Basin.

Procedures used for water sampling and sample handling are described in the *Basins Program Standard Operating Procedures River and Stream Monitoring* (MA DEP 1989). The Wall Experiment Station (WES), the Department's analytical laboratory, supplied all sample bottles and field preservatives, which were prepared according to the WES *Laboratory Quality Assurance Plan and Standard Operating Procedures* (MA DEP 1994). Samples were preserved in the field as necessary, transported on ice to WES, and analyzed according to the WES Standard Operating Procedure (SOP). The quality control protocol that was followed for field and equipment blank samples is described in Appendix A of this report. Both quality control samples (field blanks, trip blanks, and split samples) and raw water quality samples were transported on ice to WES on each sampling date; they were analyzed subsequently according to the WES SOP.

MACROINVERTEBRATES

Aquatic macroinvertebrates were collected from selected sites (Figure B3) within the Housatonic River Watershed by either kick-sampling or deployment of artificial substrates. Ten individual kicks taken within a 100-m reach of the selected stream were composited, representing a total sample area of 2 m^2. Collected material was transferred to a plastic jar, labeled, and preserved with denatured 95% ethanol (Appendix C). At sites where the kick-sampling methodology could not be applied artificial substrates (Hester Dendy samplers) were deployed on 26 August 1997 and retrieved on 8 October 1997 (Appendix D). Habitat quality was scored at each sampling location following a habitat assessment procedure modified from Plafkin *et al.* (1989).

Details related to sample handling, processing, and analysis are provided in the form of technical memoranda as follows:

- Appendix C - author: John Fiorentino. *Housatonic River Watershed 1997 Biological Assessment* RBP III methodologies.
- Appendix D - author: Gerald Szal. *1997 Housatonic Survey: Macroinvertebrate RBP II Evaluations Upstream and Downstream of NPDES Discharges.* RBP II methodologies.

FISH POPULATION

The DWM conducted a fish population survey in Karner Brook (Housatonic River Basin) during the summer of 1997. The stations were located near two of the macroinvertebrate stations (B0018, B0019). Surveys were conducted using techniques similar to Rapid Bioassement Protocols V (fish) as described by Plafkin *et al.* (1989).

Fish populations were sampled by electroshocking using a Smith Root Model 12 battery powered backpack electrofisher. A reach of approximately 100m was sampled by passing a pole mounted anode ring side to side through the stream channel and in and around likely fish holding cover. All fish shocked were netted and held in buckets. Sampling proceeded from an obstruction or constriction, upstream to an endpoint at another obstruction or constriction such as a waterfall or shallow riffle. Following completion of a sampling run, all fish were identified to species, counted, and released, if alive.

FISH TOXICS

Fish toxics monitoring is aimed primarily at assessing human health risks associated with the consumption of freshwater fishes. The program is a cooperative effort between three DEP Offices/Divisions, (i.e., Watershed Management, Research and Standards, and Environmental Analysis), Department of Fisheries and Wildlife Environmental Law Enforcement, and the Department of Public Health (DPH). Fish tissue monitoring is typically conducted to assess the concentrations of toxic contaminants in freshwater fish, identify waterbodies where those concentrations may pose a risk to human health, and identify waters where toxic chemicals may impact fish and other aquatic life. Fish tissue analysis has been restricted to edible fillets. The fish toxics monitoring was designed to screen the edible fillets of several species of fish representing different feeding guilds (i.e., bottom dwelling omnivores, top-level predators, etc.) for the presence of heavy metals, PCBs and organochlorine pesticides and to assess human health risks associated with the consumption of freshwater fishes.

Uniform protocols, designed to assure accuracy and prevent cross-contamination of samples, were followed for collecting, processing and shipping fish collected via electroshocking with a Smith Root Model 12 backpack unit from the Konkapot River. Lengths and weights were measured and fish were

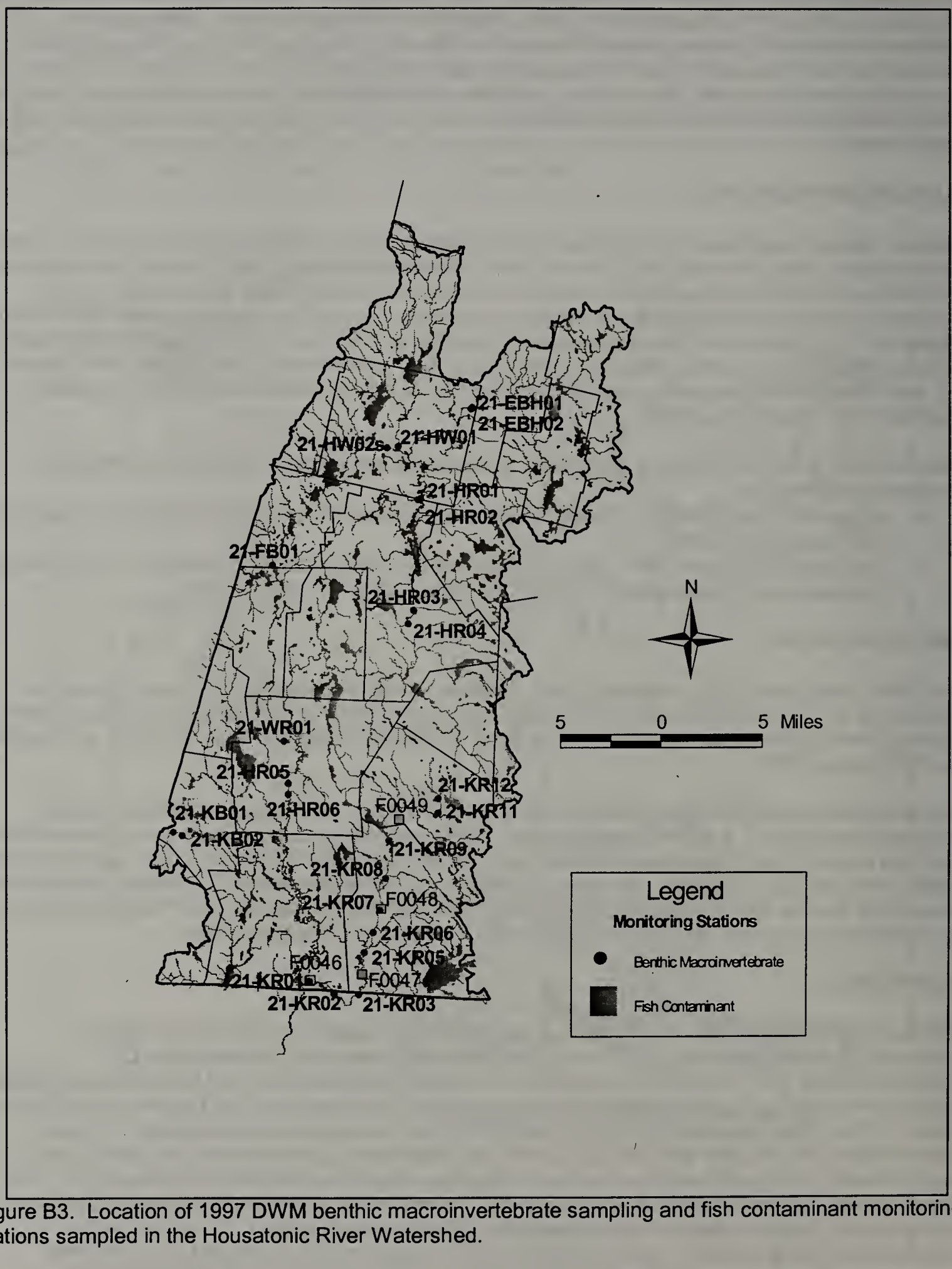

Figure B3. Location of 1997 DWM benthic macroinvertebrate sampling and fish contaminant monitoring stations sampled in the Housatonic River Watershed.

visually inspected for tumors, lesions, or other anomalies. Fish were collected from several sites on the Konkapot River (Figure B3). Fish included in the sample were placed in ice filled coolers and were processed in the field (26 August 97 survey) or brought back to the laboratory for sample processing (14 October 97 survey). Scale samples were obtained from each sample to determine the age of the fish. Fish were filleted (skin off) on glass cutting boards and prepared for freezing. All equipment used in the filleting process was rinsed (cold water for field processing, hot water for laboratory processing) to remove slime, scales, and other fluids such as blood, then re-rinsed twice in deionized water before (and/or after) each sample. Individual fillets were wrapped in aluminum foil or stored in the single sample container, whereas two to three fillets from like-sized individuals of the same species (composite sample) were wrapped together in aluminum foil or stored in the single sample container. Fillets targeted for metals analysis were placed in VWR 32-ounce high density polyethylene (HDPE) cups with covers. The opposite fillets were wrapped in aluminum foil for % lipids, PCBs and organochlorine pesticide analysis. Samples were tagged and frozen for subsequent delivery to the Department's Wall Experiment Station (WES).

Methods used at WES for metals analysis include the following:

Mercury is analyzed by a cold vapor method using a Perkin Elmer, FIMS (Flow Injection Mercury System) which uses Flow Injection Atomic Absorption Spectroscopy. Cadmium and lead are analyzed using a Perkin Elmer, Optima 3000 XL ICP – Optical Emission Spectrophotometer. Arsenic and selenium are analyzed using a Perkin Elmer, Zeeman 5100 PC, Platform Graphite Furnace, Atomic Absorption Spectrophotometer.

PCB/organochlorine pesticide analysis was performed on a gas chromatograph equipped with an electron capture detector. Additional information on analytical techniques used at WES is available from the laboratory (MA DEP 1994).

SEDIMENTS

Three samples of soft sediment were collected at two sites in the Konkapot River; Station KR01: Konkapot River approximately 15 m above the dam at Ashley Falls in a depositional area near the northern bank and from an erosional area along the southern bank and at Station KR07A and from the Konkapot River approximately 10 m above the dam at Mill River in a depositional area near the eastern bank. Sampling was conducted to screen the sediments for the presence of mercury, a qualitative assessment only for the accumulation of mercury.

Since the survey was only qualitative, EPA approved sediment collection methods were not adhered to. At each site a steel shovel was used to bring the sediment above the water surface. Using a new, disposable plastic scoop at each collection site the top inch or so of sediment was scraped away and discarded. Scoops of the sample were then transferred into a Trace Clean™ wide-mouth HDPE one-liter sample container. Care was given to avoid including sediment that had come in contact with the steel shovel. Additional shovels of sediment were collected at each site following the methods described above until each sample container was filled. The samples were then tagged in the field and were placed in a cooler at the required storage temperature of 4°C and transported to the WES laboratory.

The sediment samples were analyzed at WES for total solids, aluminum, iron and mercury within established holding times and according to methods SM2540G, EPA 6010B, EPA 6010B, and EPA 7471A, respectively. The metals data, reported in mg/kg wet weight, were converted to mg/kg dry weight by dividing the metal result by the total solid result. Sediment metals were compared to the L-EL and S-EL (lowest and severe effect levels) published by Persaud *et al.* (1993). The normalization of the sediment according to Schropp and Windom (1988) to calculate an enrichment ratio (ER) for mercury was not conducted since the sediment collection method did not follow EPA approved procedures. The sediment results can only be used to provide a qualitative assessment and cannot be used for any quantitative purpose.

LAKES

A series of synoptic surveys were conducted on a total of 32 lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) in the Housatonic River Watershed during August 1997. Eleven of the

lakes are less than 50 acres in total surface area. The lakes surveyed in 1997 were located wholly or partly within 19 different communities and were fairly evenly distributed among them. The total surface acreage of the Housatonic Watershed lakes is 5,227. Of that total, 81%, or 4,254 acres, was assessed during the 1997 surveys. Designated water supplies (i.e., Class A) accounted for only 12% (or 530 acres) of the assessed acreage.

From the information gathered during these surveys, three types of assessments were made on these lakes. First, they were assessed against the criteria for use support from the *Commonwealth of Massachusetts Summary of Water Quality 1998* report (MA DEP 1998a). Next, the trophic status (level of nutrient enrichment) of each lake was evaluated. And last, the presence of non-native aquatic and/or wetland plant species was noted. Fish advisory information was obtained from the Department of Public Health.

Synoptic surveys consisted of taking observations from at least one access point on each lake (multiple access points on larger lakes). At each lake, an attempt was made to observe the entire surface area to determine the extent of areal macrophyte cover.

At each observation site the general water quality was noted and all aquatic and wetland macrophyte species were recorded along with their general abundance and an estimate of the total percent areal coverage of all species. Qualitative macrophyte observations were aided by conducting several hauls with a plant "rake", which was constructed by bolting two garden rakes back-to-back, the handles cut to about half length, and then attached to about a 50' length of rope. Each time the rake was thrown to its maximum extension and then retrieved along the lake bottom. The rake was thrown several times in different directions from the observation site to provide more thorough coverage.

Where possible, transparency was measured using a standard 20-centimeter diameter Secchi disc attached to a rope with metric calibrations. When Secchi disc measurements were not feasible, transparency was estimated as being above or below 1.2 meters (based on the 4 foot Secchi disc bathing beach standard).

All observations were recorded on standardized field sheets. Assessments of trophic status and use impairment were made on site. Later, the assessments and supporting information were entered into the US EPA Water Body System database. Data on the presence of non-native plants were entered into a separate database intended for linking to the Massachusetts Geographic Information System (MassGIS).

RESULTS

SURVEY CONDITIONS

To fulfill the assessment guidance, information on precipitation (MA DEM 1998) and stream discharge (Socolow *et al.* 1998 and 1999) were analyzed to estimate hydrological conditions during the water quality sampling events. This review was conducted to estimate the streamflow condition in relation to the 7-day, 10-year (7Q10) low flow. Additionally, this review was used to determine whether the fecal coliform bacteria data were representative of "wet" or "dry weather" sampling conditions.

Generally, the flows during the sampling events were below average monthly conditions. A single exception was noted in June 1998 when flows were almost 2 and 2.4 times higher (East Branch Housatonic River and mainstem Housatonic River gages, respectively) than the monthly average for the period-of-record as reported Socolow *et al.* (1999). Survey conditions are described below for each DWM sampling event reviewed for the assessment.

22 July 1997: The first survey performed during the summer of 1997 occurred during the lowest flow condition of any of the Konkapot River water quality sampling events. This survey was conducted during and following relatively dry weather (Table B2). Streamflows in both the East Branch and Housatonic Rivers were below the monthly averages for July 1997 as well as the period of record for each gage (Table B3). Discharge was approximately two times higher than the 7-day, 10-year (7Q10) low flow estimates at either gage (USGS 1998). Data collected during this survey will be interpreted as being representative of dry weather conditions.

26 August 1997: A sizable storm (0.82 inches of rain) preceded the August sampling event by one day (Table B2). Although the mainstem Housatonic River gage at Great Barrington did not reflect the response of the stream to the storm until the day after the survey (Table B3), the data collected will be interpreted as being representative of wet weather conditions.

30 September 1997: Almost a half inch of precipitation was recorded at the Stockbridge Station two days prior to the water quality sampling event on the Konkapot River (Table B2). Another two-tenths inches of precipitation occurred on the day prior to the survey. As detailed in Table B3 flow conditions recorded at the USGS Housatonic River Great Barrington gage increased by approximately one-third (Figure B4). Although the Konkapot River may respond more quickly to a precipitation event, the data (interpreted with caution) will be considered as being representative of wet weather conditions.

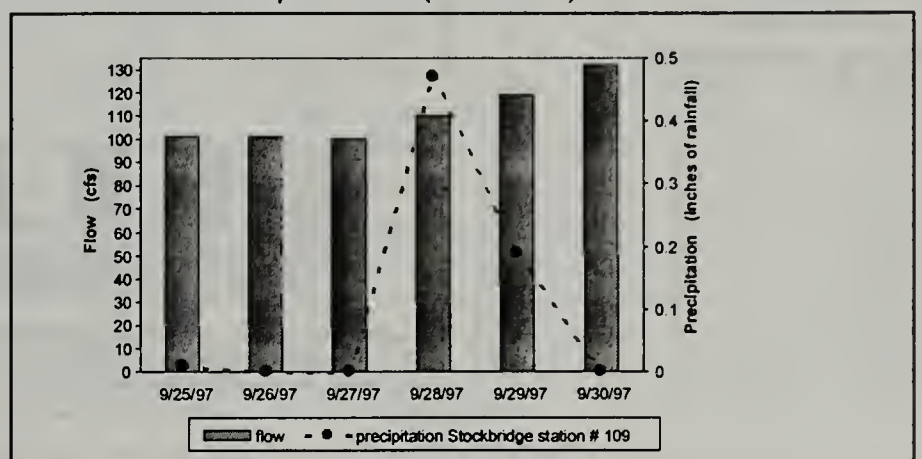

Figure B4: Flow and precipitation data for the Housatonic River during the period of 9/25/97 through 9/30/97. Flow data from USGS Gage 01197500 Housatonic River near Great Barrington, MA. Precipitation data from Stockbridge station #109.

29 October 1997: Although significant precipitation was recorded five and three days prior to the survey (see Figure B5, and Table B2), discharge in the mainstem Housatonic River (Table B3) had peaked and was receding by the day of the survey. It is considered likely that the Konkapot River was also returning to pre-storm levels and was approaching normal ambient flow conditions. The data collected during

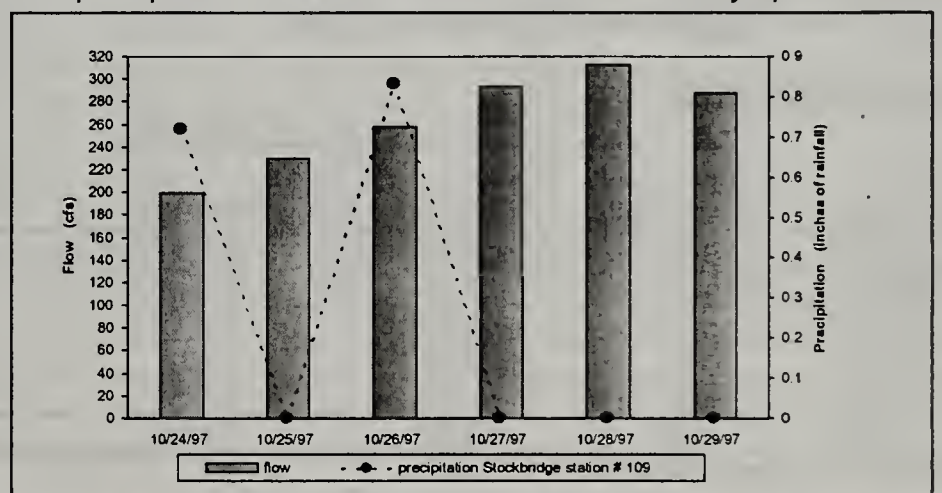

Figure B5: Flow and precipitation data for the Housatonic River during the period of 10/24/97 through 10/29/97. Flow data from USGS Gage 01197500 Housatonic River near Great Barrington, MA. Precipitation data from Stockbridge station #109.

19 May 1998: A small storm (0.23 inches of precipitation) occurred two days prior to the sampling event (Table B2) without any discernable effects on streamflow (Table B3). This survey will be considered as representing dry weather conditions.

2 June 1998: A major storm event (1.85 inches of rain) preceded the water quality sampling in the Konkapot River by two days (Figure B6 and Table B2). Flow in the mainstem Housatonic River rose from 205 cfs to a high of 988 cfs on the day of the survey (Table B3). This survey will be considered as representing wet weather conditions.

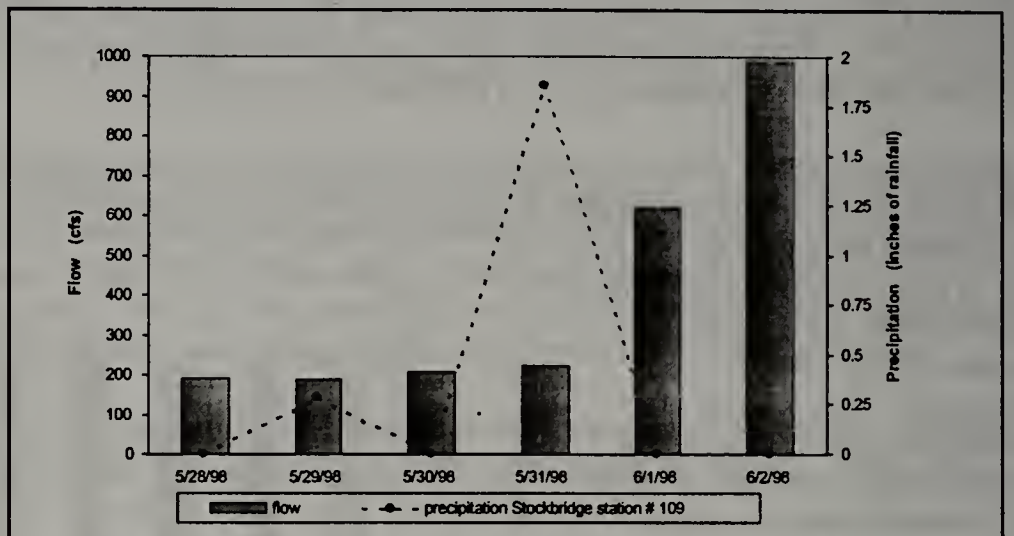

Figure B6: Flow and precipitation data for the Housatonic River during the period of 5/28/98 through 6/2/98. Flow data from USGS Gage 01197500 Housatonic River near Great Barrington, MA. Precipitation data from Stockbridge station #109.

Table B2. 1997/1998 MA DEM Precipitation Data Summary (MA DEM 1998).

Housatonic River Basin Survey
Precipitation Data Summary (reported in inches of rain)

Stockbridge Station # 109

	Precipitation					
Survey Dates	5 Days Prior	4 Days Prior	3 Days Prior	2 Days Prior	1 Days Prior	Sample Date
7/22/97	0.00	0.00	0.00	0.00	0.23	0.00
8/26/97	0.10	0.01	0.00	T*	0.82	0.10
9/30/97	<0.01	0.00	0.00	0.47	0.19	0.00
10/29/97	0.72	0.00	0.83	0.00	0.00	0.00
5/19/98	0.00	0.00	0.02	0.23	0.00	0.00
6/2/98	0.00	0.28	0.00	1.85	0.00	0.00

* trace amount of precipitation noted

Table B3. 1997/1998 USGS Flow Data Summary (Socolow *et al.* 1998 and 1999).

Housatonic River Basin Survey
USGS Flow Data Summary (reported in cfs)

East Branch Housatonic River at Coltsville, MA (Provisional 7Q10 = 12.434 cfs USGS 1998)

Gage #01197000

Survey Dates	Flow 5 Days Prior	4 Days Prior	3 Days Prior	2 Days Prior	1 Days Prior	Sample Date	Monthly Mean	POR* Monthly Mean
7/22/97	43	55	36	25	23	22	43.7	53.3
8/26/97	34	39	39	34	27	31	32.8	47.2
9/30/97	24	24	34	25	31	32	21.6	53.7
10/29/97	21	27	31	50	54	36	31.7	70.1
5/19/98	129	108	95	94	94	81	111	141
6/2/98	31	32	56	125	631	154	223	82.8

Housatonic River near Great Barrington, MA (Provisional 7Q10 = 69.330 cfs USGS 1998)

Gage #01197500

Survey Dates	Flow 5 Days Prior	4 Days Prior	3 Days Prior	2 Days Prior	1 Days Prior	Sample Date	Monthly Mean	POR Monthly Mean
7/22/97	156	160	163	140	125	127	219	277
8/26/97	160	174	174	167	145	140	175	240
9/30/97	101	101	100	110	119	132	113	256
10/29/97	199	230	258	293	312	287	168	307
5/19/98	622	527	462	415	410	377	441	691
6/2/98	192	189	205	222	620	988	980	414

* Period of Record

STREAM WATER QUALITY MONITORING

All DEP water quality data is managed and maintained in an Access Database (Dallaire 1999). The Hydrolab *in-situ* results are provided in Table B4. Discrete water sampling data includes physico-chemical (Table B5) and bacterial data (Table B6).

Table B4. 1997/1998 DEP DWM Housatonic River Basin, *in-situ* hydrolab data.

		Time (24hr)	Measurement Depth (m)	Temp (°C)	pH (SU)	Cond (uS/cm)	TDS (g/l)	DO (mg/l)	SAT (%)	Turb (NTU)
KONKAPOT RIVER										
Station: KR12, Mile Point: 22.1										
Description: upstream/north at Beartown Mtn Rd, Monterey. Standing on pipe emerging from earth berm retaining Brewer Lake.										
21-0016	07/22/97	13:19	<0.3	25.2	8.0	115	0.07	7.9	94	**
21-0025	08/26/97	11:55	0.6	21.2	8.3	118	0.08	7.4	81	--
21-0042	09/30/97	11:37	<0.3	14.6	7.9	116	0.07	9.5	94	--
21-0054	10/29/97	11:30	1.0	3.8	7.6	118	0.07	11.9	89	--
KONKAPOT RIVER										
Station: KR11, Mile Point: 21.2										
Description: downstream/south at Route 23, Monterey.										
21-0012	07/22/97	12:42	<0.3	21.4	7.6	139	0.09	9.0	99	5
21-0024	08/26/97	11:34	<0.3	18.7	7.6	133	0.09	9.0	95	--
21-0041	09/30/97	11:14	<0.3	13.3	7.5	139	0.09	9.3	89	--
21-0066	10/29/97	11:42	<0.3	4.3	7.5	117	0.07	12.1	92	9
KONKAPOT RIVER										
Station: KR10, Mile Point: 19										
Description: downstream/northwest at Curtis Road bridge, Monterey.										
21-0011	07/22/97	12:16	<0.3	19.7	7.6	237	0.2	8.3	89	16
21-0023	08/26/97	11:16	<0.3	17.1	7.6	211	0.1	8.2	83	--
21-0040	09/30/97	10:59	<0.3	12.3	7.6	236	0.2	9.0	85	--
21-0065	10/29/97	11:24	<0.3	4.3	7.5	143	0.09	12.0	91	9
KONKAPOT RIVER										
Station: KR09, Mile Point: 16.1										
Description: downstream/south at Hartsville Mill Road, New Marlborough. Southeast of Lake Buel outlet, west of New Marlborough locality of Hartsville.										
21-0010	07/22/97	11:49	<0.3	21.0	8.4	237	0.2	8.9	98	8
21-0022	08/26/97	10:50	<0.3	16.1	8.3	215	0.1	9.8	97	--
21-0039	09/30/97	10:34	<0.3	12.3	8.1	265	0.2	9.7	92	--
21-0064	10/29/97	10:47	<0.3	4.6	7.9	147	0.09	12.2	94	3
KONKAPOT RIVER										
Station: KR08, Mile Point: 13.1										
Description: upstream/north at Hartsville Mill River Road bridge which is approximately 3/10 mile northwest of New Marlborough Hill Road.										
21-0009	07/22/97	11:20	<0.3	18.9	7.8	252	0.2	7.9	83	13
21-0034	08/26/97	12:25	<0.3	16.8	7.9	234	0.1	8.9	90	7
21-0049	09/30/97	12:54	<0.3	12.3	7.7	272	0.2	8.9	84	<1
21-0063	10/29/97	10:24	<0.3	4.8	7.5	167	0.1	11.6	90	8
KONKAPOT RIVER										
Station: KR07, Mile Point: 11.7										
Description: east side at Clayton Mill River Road, north of Mill River Road bridge downstream of old dam, New Marlborough. (Remains of old dam on banks only.)										
21-0007	07/22/97	11:53	<0.3	19.6	8.3	261	0.2	9.4	100	--
21-0020	08/26/97	10:07	<0.3	15.3	8.3	250	0.2	10.3	101	--
21-0037	09/30/97	10:00	<0.3	12.2	8.2	288	0.2	10.6	99	--
21-0052	10/29/97	10:49	<0.3	5.1	8.1	179	0.1	12.9	100	--
KONKAPOT RIVER										
Station: KR06, Mile Point: 9.8										
Description: east side Clayton Mill River Road approximately 1 and 1/2 miles north of Konkapot Road/Clayton Mill River Road intersection, New Marlborough. Utility pole #MEC0645 N.E.Tel#43.										
21-0008	07/22/97	10:51	<0.3	17.5	8.3	272	0.2	9.5	97	28*
21-0032	08/26/97	11:57	0.3	16.0	8.4	267	0.2	10.3	101	7
21-0048	09/30/97	12:27	<0.3	12.5	8.4	291	0.2	9.9	94	<1
21-0061	10/29/97	09:53	<0.3	4.8	8.0	190	0.1	12.8	99	3

* = outside calibrated range, ** = censored data, -- = no data

Table B4. Continued. 1997/1998 DEP DWM Housatonic River Basin, *in-situ* hydrolab data.

		Time (24hr)	Measurement Depth (m)	Temp (°C)	pH (SU)	Cond (uS/cm)	TDS (g/l)	DO (mg/l)	SAT (%)	Turb (NTU)
KONKAPOT RIVER										
Station: KR05, Mile Point: 8.5										
Description: upstream/east at Konkapot Road bridge, New Marlborough.										
21-0006	07/22/97	10:21	<0.3	17.4	8.3	273	0.2	9.1	93	19
21-0031	08/26/97	11:33	<0.3	15.7	8.4	265	0.2	10.2	100	6
21-0047	09/30/97	12:07	<0.3	12.9	8.4	293	0.2	10.0	95	<1
21-0059	10/29/97	09:27	<0.3	4.7	7.9	194	0.1	12.5	96	9
KONKAPOT RIVER										
Station: KR04, Mile Point: 7.3										
Description: upstream/north at Canaan-Southfield Road bridge, New Marlborough.										
21-0005	07/22/97	11:22	<0.3	18.7	8.2	277	0.2	9.7	101	–
21-0030	08/26/97	11:07	<0.3	15.8	8.2	270	0.2	9.7	96	6
21-0045	09/30/97	11:46	<0.3	12.9	8.2	299	0.2	9.9	94	<1
21-0058	10/29/97	10:26	0.6	4.8	8.0	200	0.1	12.5	96	–
KONKAPOT RIVER										
Station: KR03, Mile Point: 5.3										
Description: upstream/northeast at Old Turnpike North bridge, North Canaan, Connecticut.										
21-0004	07/22/97	11:01	<0.3	18.3	8.0	280	0.2	9.3	97	–
21-0028	08/26/97	10:39	<0.3	15.7	8.1	275	0.2	9.0	88	5
21-0044	09/30/97	11:24	<0.3	13.0	8.1	302	0.2	9.3	88	9
21-0057	10/29/97	10:04	0.4	4.7	7.8	203	0.1	11.9	91	–
KONKAPOT RIVER										
Station: KR02, Mile Point: 3										
Description: upstream/south at Route 124 bridge, North Canaan, Connecticut.										
21-0003	07/22/97	10:29	<0.3	17.5	8.0	301	0.2	9.4	96	–
21-0027	08/26/97	10:04	<0.3	15.2	8.0	303	0.2	9.1	88	**
21-0043	09/30/97	09:20	<0.3	12.4	7.8	326	0.2	8.6	81	6
21-0056	10/29/97	09:42	<0.3	5.0	7.8	221	0.1	11.8	92	–
KONKAPOT RIVER										
Station: KR01, Mile Point: 0.8										
Description: downstream/west at Route 7A bridge, Sheffield, (locality of Ashley Falls).										
21-0001	07/22/97	09:41	<0.3	17.1	8.0	305	0.2	9.1	93	38*
21-0019	08/26/97	09:26	0.3	15.5	8.0	306	0.2	9.2	90	–
21-0035	09/30/97	09:15	<0.3	12.6	7.9	332	0.2	9.1	86	–
21-0051	10/29/97	09:14	<0.3	5.2	7.8	231	0.1	12.3	96	–

* = outside calibrated range, ** = censored data, -- = no data

Table B5. 1997 DEP DWM Housatonic River Basin, instream physico/chemical data. All units in mg/L unless otherwise noted.

			Time (24hr)	Alkalinity	Hardness	Specific Conductivity (umhos)	Chloride	Suspended Solids	Total Solids	Turbidity (NTU)	Total Kjeldahl Nitrogen	Ammonia	Nitrate	Total Phosphorus
KONKAPOT RIVER														
Station: KR12, Mile Point: 22.1														
Description: upstream/north at Beartown Mountain Road, Monterey. Standing on pipe emerging from earth berm retaining Brewer Lake.														
21-0013	21-0014	07/22/97	12:45	43	47	--	7.0	**	--	1.1	--	<0.02	0.02	0.02
21-0014	21-0013	07/22/97	12:45	43	46	--	7.0	**	--	1.1	--	<0.02	0.02	0.02
21-0025		08/26/97	11:52	44	**	--	7.0	<2.5	--	1.0	--	<0.02	0.02	0.02
21-0042		09/30/97	11:35	45	48	--	6.0	<2.5	--	**	--	<0.02	0.02	0.01
21-0054		10/29/97	11:27	53	**	--	6.0	<2.5	--	**	--	0.02	<0.02	0.02
KONKAPOT RIVER														
Station: KR07, Mile Point: 11.7														
Description: east side at Clayton Mill River Road, north of Mill River Road bridge downstream of old dam, New Marlborough. (Remains of old dam on banks only.)														
21-0007		07/22/97	11:47	117	129	--	12	**	--	0.70	--	<0.02	0.10	<0.01
21-0020	21-0021	08/26/97	10:04	118	**	--	9.0	<2.5	--	0.60	--	<0.02	0.09	<0.01
21-0021	21-0020	08/26/97	10:04	118	**	--	10	<2.5	--	0.60	--	<0.02	0.09	<0.01
21-0037		09/30/97	9:56	131	161	--	12	<2.5	--	**	--	<0.02	0.09	<0.01
21-0052	21-0053	10/29/97	10:46	78	**	--	7.0	<2.5	--	**	--	0.02	<0.02	0.03
21-0053	21-0052	10/29/97	10:46	79	**	--	7.0	<2.5	--	**	--	<0.02	<0.02	<0.01
KONKAPOT RIVER														
Station: KR01, Mile Point: 0.8														
Description: downstream/west at Route 7A bridge, Sheffield, (locality of Ashley Falls).														
21-0001		07/22/97	9:40	140	159	--	12	**	--	0.80	--	<0.02	0.42	0.01
21-0019		08/26/97	9:22	145	**	--	10	2.8	--	0.75	--	<0.02	0.46	0.02
21-0035	21-0036	09/30/97	9:15	161	204	--	9.0	2.6	--	**	--	<0.02	0.49	0.02
21-0036	21-0035	09/30/97	9:15	159	202	--	9.0	<2.5	--	**	--	<0.02	0.53	0.02
21-0051		10/29/97	9:11	103	**	--	9.0	<2.5	--	**	--	0.02	0.02	0.01

* = interference ** = missing/censored data -- = no data

Table B6. 1997/1998 DEP DWM Housatonic River Basin bacteria data. Units in cfu/100 mLs.

			Time (24hr)	FECAL	E-COLI	ENTEROCOCCUS	AEROMONAS
Unnamed and/or Undefined SARIS							
Station: KR02B, Mile Point: 0.8							
Description: Squabble Brook, downstream/west at Allyndale Road, North Canaan, Connecticut (south of locality of Sodom, Connecticut).							
21-0071		05/19/98	10:15	360	40	120	--
21-0099		06/02/98	8:4	**	**	**	--
Unnamed and/or Undefined SARIS							
Station: KR02C, Mile Point: 0.01							
Description: Squabble Brook, just upstream of confluence with Konkapot River, North Canaan, Connecticut (northwest of locality of Sodom, Connecticut).							
21-0082		05/19/98	9:55	940	<20	4,000	--
KONKAPOT RIVER							
Station: KR12, Mile Point: 22.1							
Description: upstream/north at Beartown Mountain Road, Monterey. Standing on pipe emerging from earth berm retaining Brewer Lake.							
21-0013	21-0014	07/22/97	12:45	**	--	--	--
21-0014	21-0013	07/22/97	12:45	**	--	--	--
21-0025		08/26/97	11:52	<20	<20	--	--
21-0042		09/30/97	11:35	<20	<20	--	--
21-0054		10/29/97	11:27	140	<20	--	--
KONKAPOT RIVER							
Station: KR11, Mile Point: 21.2							
Description: downstream/south at Route 23, Monterey.							
21-0012		07/22/97	12:42	**	--	--	--
21-0024		08/26/97	11:31	<20	<20	--	--
21-0041		09/30/97	11:10	40	<20	--	--
21-0066		10/29/97	11:50	<20	<20	--	--
KONKAPOT RIVER							
Station: KR10, Mile Point: 19							
Description: downstream/northwest at Curtis Road bridge, Monterey.							
21-0011		07/22/97	12:16	**	--	--	--
21-0023		08/26/97	11:13	<20	<20	--	--
21-0040		09/30/97	10:56	140	80	--	--
21-0065		10/29/97	11:24	20	<20	--	--
KONKAPOT RIVER							
Station: KR09, Mile Point: 16.1							
Description: downstream/south at Hartsville Mill Road, New Marlborough. Southeast of Lake Buel outlet, west of New Marlborough locality of Hartsville.							
21-0010		07/22/97	11:50	**	--	--	--
21-0022		08/26/97	10:47	<20	<20	--	--
21-0039		09/30/97	10:31	60	60	--	--
21-0064		10/29/97	10:47	*	*	--	--
KONKAPOT RIVER							
Station: KR08, Mile Point: 13.1							
Description: upstream/north at Hartsville Mill River Road bridge which is approximately 3/10 mile northwest of New Marlborough Hill Road.							
21-0009		07/22/97	11:20	**	--	--	--
21-0034		08/26/97	12:25	40	<20	--	--
21-0049	21-0050	09/30/97	12:54	120	60	--	--
21-0050	21-0049	09/30/97	12:54	140	60	--	--
21-0063		10/29/97	10:24	20	<20	--	--
KONKAPOT RIVER							
Station: KR07A, Mile Point: 11.9							
Description: northwest of locality of Mill River, immediately above dam which is northwest of Hayes Hill Road, Mill River Gr Barrington Road intersection, New Marlborough.							
21-0079	21-0080	05/19/98	11:15	<20	<20	60	--
21-0080	21-0079	05/19/98	11:15	<20	<20	<20	--
21-0108	21-0109	06/02/98	10:05	**	**	**	--
21-0109	21-0108	06/02/98	10:05	**	**	**	--

* = interference ** = missing/censored data -- = no data

Table B6. Continued. 1997/1998 DEP DWM Housatonic River Basin bacteria data. Unit: cfu/100 mLs.

			Time[24hr]	FECAL	E-COLI	ENTEROCOCCUS	AEROMONAS
KONKAPOT RIVER							
Station: KR07, Mile Point: 11.7							
Description: east side at Clayton Mill River Road, north of Mill River Road bridge downstream of old dam, New Marlborough. (Remains of old dam on banks only.)							
21-0007		07/22/97	11:47	**	--	--	--
21-0020	21-0021	08/26/97	10:04	40	20	--	--
21-0021	21-0020	08/26/97	10:04	60	<20	--	--
21-0037		09/30/97	9:56	80	<20	--	--
21-0052	21-0053	10/29/97	10:46	<20	<20	--	--
21-0053	21-0052	10/29/97	10:46	*	<20	--	--
21-0078		05/19/98	11:12	80	<20	60	--
21-0107		06/02/98	9:50	**	**	**	--
KONKAPOT RIVER							
Station: KR06, Mile Point: 9.8							
Description: east side Clayton Mill River Road approximately 1 and 1/2 miles north of Konkapot Road/Clayton Mill River Road intersection, New Marlborough. Utility pole #MEC0645 N.E.Tel#43.							
21-0008		07/22/97	10:51	**	--	--	--
21-0032	21-0033	08/26/97	11:57	40	<20	--	--
21-0033	21-0032	08/26/97	11:57	20	<20	--	--
21-0048		09/30/97	**	20	20	--	--
21-0061		10/29/97	9:50	60	<20	--	--
21-0076		05/19/98	10:57	20	<20	<20	--
21-0105		06/02/98	9:30	**	**	**	--
KONKAPOT RIVER							
Station: KR05, Mile Point: 8.5							
Description: upstream/east at Konkapot Road bridge, New Marlborough.							
21-0006		07/22/97	10:22	**	--	--	--
21-0031		08/26/97	11:33	20	<20	--	--
21-0047		09/30/97	12:07	80	<20	--	--
21-0059	21-0060	10/29/97	9:27	20	<20	--	--
21-0060	21-0059	10/29/97	9:27	*	<20	--	--
21-0075		05/19/98	10:50	20	<20	80	--
21-0104		06/02/98	9:20	**	**	**	--
KONKAPOT RIVER							
Station: KR04, Mile Point: 7.3							
Description: upstream/north at Canaan-Southfield Road bridge, New Marlborough.							
21-0005		07/22/97	11:19	**	--	--	--
21-0030		08/26/97	11:07	40	20	--	--
21-0045		09/30/97	11:46	120	20	--	--
21-0058		10/29/97	10:23	20	<20	--	--
21-0074		05/19/98	10:45	<20	<20	20	--
21-0103		06/02/98	9:15	**	**	**	--
KONKAPOT RIVER							
Station: KR03A, Mile Point: 6.8							
Description: off the eastern side of Canaan-Southfield Road approximately 1 road mile north of the Connecticut/Massachusetts border, New Marlborough.							
21-0073		05/19/98	10:40	20	<20	<20	--
21-0102		06/02/98	9:05	**	**	**	--
KONKAPOT RIVER							
Station: KR03, Mile Point: 5.3							
Description: upstream/northeast at Old Turnpike North bridge, North Canaan, Connecticut.							
21-0004		07/22/97	10:56	**	--	--	--
21-0028		08/26/97	10:39	220	<20	--	--
21-0044		09/30/97	11:24	440	80	--	--
21-0057		10/29/97	10:01	80	40	--	--
21-0072		05/19/98	10:30	<20	<20	40	--
21-0101		06/02/98	8:55	**	**	**	--
KONKAPOT RIVER							
Station: KR02A, Mile Point: 4.2							
Description: downstream/west at Allyndale Road, North Canaan, Connecticut (northwest of locality of Sodom).							
21-0070		05/19/98	9:35	20	<20	<20	--
21-0098		06/02/98	8:15	**	**	**	--

* = interference ** = missing/censored data -- = no data

Table B6. Continued. 1997/1998 DEP DWM Housatonic River Basin bacteria data. Units: cfu/100 mLs.

			Time (24hr)	FECAL	E-COLI	ENTEROCOCCUS	AEROMONAS
KONKAPOT RIVER							
Station: KR02, Mile Point: 3							
Description: upstream/south at Route 124 bridge, North Canaan, Connecticut.							
21-0003		07/22/97	10:26	**	--	--	--
21-0027		08/26/97	10:04	240	160	--	--
21-0043		09/30/97	**	700	340	--	--
21-0056		10/29/97	9:40	500	340	--	--
21-0069		05/19/98	9:25	160	<20	180	--
21-0097		06/02/98	8:10	**	**	**	--
KONKAPOT RIVER							
Station: KR01A, Mile Point: 1.5							
Description: upstream/east at Route 7, Sheffield, locality of Ashley Falls.							
21-0068		05/19/98	9:15	500	60	120	--
21-0096		06/02/98	8:35	**	**	**	--
KONKAPOT RIVER							
Station: KR01, Mile Point: 0.8							
Description: downstream/west at Route 7A bridge, Sheffield, (locality of Ashley Falls).							
21-0001		07/22/97	9:40	**	--	--	--
21-0019		08/26/97	9:22	420	160	--	--
21-0035	21-0036	09/30/97	9:15	640	1,000	--	--
21-0036	21-0035	09/30/97	9:15	660	<20	--	--
21-0051		10/29/97	9:11	240	120	--	--
21-0067		05/19/98	9:05	140	<20	60	--
21-0095		06/02/98	8:00	**	**	**	--
UMPACHENE RIVER							
Station: KR06A, Mile Point: 0.01							
Description: just upstream of confluence with Konkapot River. Southeast of the intersection of Clayton Mill River Road, Brewer Branch Road and Hadsell Street.							
21-0077		05/19/98	11:02	40	<20	<20	--
21-0106		06/02/98	9:35	**	**	**	--

* = interference ** = missing/censored data -- = no data

MACROINVERTEBRATES

Results from DEP DWM's 1997 benthic macroinvertebrate studies in the Housatonic River Basin are presented in Appendix C (Housatonic River Watershed 1997 Biological Assessment, author: John Fiorentino) and Appendix D (1997 Housatonic Survey: Macroinvertebrate RBP II Evaluations Upstream and Downstream of NPDES Discharges, author: Gerald Szal) of this report.

FISH POPULATION

Results from the 1997 fish population survey (MA DEP 1997a) are presented in Table B7.

Table B7. 1997 DEP DWM Housatonic River Basin Survey. Fish population data collected 26 August 1997.

Stations	Species[1]	
	EBT	SS
Karner Brook (KB02) adjacent to Mount Washington Road, downstream/southeast of water withdrawal structure, Egremont.	13 (38 TNTC*)[2]	22 (TNTC)
Karner Brook (KB01) adjacent to Mount Washington Road, upstream/northwest of water withdrawal structure, Egremont. *(started approximately 20 meters upstream/northwest from bridge at residence)*	10(77)	

[1]Species Code — Common Name — Scientific Name
EBT — brook trout — Salvelinus fontinalis
SS — slimy sculpin — Cottus cognatus

[2] (number of young-of-the-year counted)
* (TNTC) too numerous to count

FISH TOXICS

Konkapot River fish were first sampled for toxic contaminants in 1997 as part of a biological survey of the Housatonic River Watershed. Survey results (MA DEP 1997b) are presented in Table B8. The goal was to screen resident fishes for PCBs, organochlorine pesticides, and selected metals. Station locations (above and below the Ashley Falls Dam) were chosen in an attempt to document whether fish from the Housatonic River (located 1.4 km downstream) were migrating into the Konkapot River. The theory was that if fish were migrating from the Housatonic River, they would contain detectable concentrations of PCBs, whereas, fish from upstream of the dam would not.

Electrofishing was conducted on 26 August 1997 upstream (F0046) and downstream (F0045) of the dam at Ashley Falls on the Konkapot River. Where possible, fish selected for analysis (Table B8) represented species and sizes desired by the angling public for consumption, as well as from different feeding guilds (i.e., predator, invertivore, omnivore).

As detailed in Table B8 three fish, a brown trout (*Salmo trutta*), a largemouth bass (*Micropterus salmoides*), and a white sucker (*Catostomus commersoni*) were collected downstream of the dam. Three brown trout and one white sucker were collected above the dam. All seven fish were analyzed individually for metals (As, Cd, Pb, Hg and Se).

Due to the elevated concentrations of mercury in fish tissue at both stations (0.41 - 1.06 mg/kg wet weight) and the small sample size, additional fish toxics monitoring in the Konkapot River was warranted. Follow-up sampling via electrofishing was conducted on 14 October 1997. At the farthest upstream station near Hatchery-River Road (F0049), Monterey two composite samples of brown trout and one individual white sucker were retained for analysis. Longnose dace (*Rhinichthys cataractae*) and blacknose dace (*Rhinichthys atratulus*) were also observed. This station is upstream of the dam located in the village of Mill River in New Marlborough. At Clayton Mill Road (F0048), New Marlborough two composite samples of brown trout were submitted for analysis. This station is located downstream of the dam at Mill River Village. Additional species observed in the stream included slimy sculpin (*Cottus cognatis)*, longnose dace, blacknose dace, and common shiner (*Notropis cornutus*). A composite sample of two white suckers was collected at Caanan-Southfield Road (F0047), New Marlborough. This location is downstream of the confluence with the Umpachene River. Although not retained for analysis, two additional species were observed: slimy sculpin and blacknose dace.
Table B8 lists species, length, and weight data for individual fish as well as the analytical results. Arsenic, cadmium, and lead were not detected in the edible fillets of any sample analyzed. Selenium was detected in all samples analyzed ranging from 0.147 to 0.421 mg/kg wet weight. Mercury in the fish tissue from the uppermost station on the Konkapot River ranged between 0.08 and 0.28 mg/kg wet weight. Mercury was

slightly elevated in a sample of brown trout (Krf 97-8-10, 0.44 mg/kg wet weight) and white sucker (Krf 97-14-15, 0.56 mg/kg wet weight) collected downstream of the dam at Mill River Village, New Marlborough.

Table B8. 1997 Housatonic River Basin Survey. Fish toxics monitoring data (mg/kg wet wt.) for the Konkapot River, Monterey/New Marlborough/Sheffield.

Analysis #	Sample ID	Collection Date	Species Code[1]	Sample Code[2]	Length (cm)	Weight (gm)	Cd	Pb	Hg	As	Se	% Lipids	PCB (µg/g)	Pesticides (µg/g)
Station F0049: upstream of the Mill River dam, at Hatchery-River Road, Monterey														
97053	Krf97-16	10/14/97	BT	C	30.4	320	<0.020	<0.140	0.280	<0.040	0.147	0.92	ND	ND
	Krf97-17	10/14/97	BT	C	28.6	260								
97054	Krf97-18	10/14/97	BT	C	28.0	210	<0.020	<0.140	0.080	<0.040	0.159	1.2	ND	ND
	Krf97-19	10/14/97	BT	C	26.2	200								
97055	Krf97-22	10/14/97	WS	I	35.2	460	<0.020	<0.140	0.126	<0.040	0.152	0.18	ND	ND
Station F0048: At Clayton Mill River Road, New Marlborough.														
97050	Krf97-8	10/14/97	BT	C	27.3	240	<0.020	<0.140	0.440	<0.040	0.232	1.0	ND	ND
	Krf97-9	10/14/97	BT	C	31.0	290								
	Krf97-10	10/14/97	BT	C	27.9	240								
97051	Krf97-11	10/14/97	BT	C	23.2	150	<0.020	<0.140	0.186	<0.040	0.228	0.60	ND	ND
	Krf97-12	10/14/97	BT	C	22.1	130								
	Krf97-13	10/14/97	BT	C	22.4	140								
Station F0047: at Canaan-Southfield Road, New Marlborough.														
97052	Krf97-14	10/14/97	WS	C	21.9	120	<0.020	<0.140	0.560	<0.040	0.193	0.30	ND	ND
	Krf97-15	10/14/97	WS	C	24.2	150								
Station F0046: upstream of the dam at Ashley Falls, Sheffield.														
97016	Krf97-4	08/26/97	WS	I	31.1	**	<0.020	<0.140	0.820	<0.040	0.208	1.5	ND[3]	ND[3]
97017	Krf97-5	08/26/97	BT	I	31.5	**	<0.020	<0.140	0.990	<0.040	0.291	1.4	ND[3]	ND[3]
97018	Krf97-6	08/26/97	BT	I	32.1	**	<0.020	<0.140	1.06	<0.040	0.216	2.5	ND[3]	ND[3]
97019	Krf97-7	08/26/97	BT	I	21.5	**	<0.020	<0.140	0.410	<0.040	0.214	0.72	ND[3]	ND[3]
Station F0045: downstream of the dam at Ashley Falls, Sheffield.														
97013	Krf97-1	08/26/97	LMB	I	26.2	**	<0.020	<0.140	1.05	<0.040	0.164	0.21	ND[3]	ND[3]
97014	Krf97-2	08/26/97	BT	I	34.9	**	<0.020	<0.140	1.05	<0.040	0.421	1.4	0.80*[3]	ND[3]
97015	Krf97-3	08/26/97	WS	I	23.5	**	<0.020	<0.140	0.640	<0.040	0.158	0.53	ND[3]	ND[3]

[1]Species

Species	Common Name	Scientific Name
BT	brown trout	*Salmo trutta*
LMB	largemouth bass	*Micropterus salmoides*
WS	white sucker	*Castomus commersoni*

[2]Sample Type (All samples were fillets with skin off.)
Composite (C)
Individual (I)

*Arochlor 1260

** not weighed

[3] Analyzed just beyond the EPA recommended holding time although extraction was within holding time.

Based on the results of the mercury analysis in fish tissue at these five sampling stations, (using a trigger level of 0.5 mg/kg wet weight Hg) DPH issued a Fish Consumption Advisory for the Konkapot River from the village of Mill River to the confluence with the Housatonic River on 6 February 1998 (DPH 1998). The advisory warns children younger than 12 years old, pregnant women and nursing mothers not to eat fish from the Konkapot River in the section described above. The advisory also recommends that the general public should limit consumption of all fish caught from this segment of the Konkapot River to two meals per month.

PCBs were below detection in all samples analyzed except for the single brown trout collected from the Konkapot River downstream of the dam at Ashley Falls (Table B8). The brown trout (Krf97-2) was found to contain 0.80 mg/kg of PCB Arochlor 1260, which is just slightly below the MDPH PCB trigger level of 1.0 mg/kg. Organochlorine pesticides were not detected in any of the samples analyzed. The % lipids content of the fish analyzed from the Konkapot River ranged between 0.18 and 2.5%.

Fish from below the Ashley Falls dam have unrestricted access to the mainstem of the Housatonic River. Although not all species of fish routinely migrate appreciable distances, individual fish certainly do disperse. It is possible that the brown trout had migrated from the mainstem Housatonic River. The current Housatonic River advisory for PCBs recommends that "Fish taken from feeder streams to the Housatonic River should be trimmed of fatty tissue prior to cooking." While this advisory may be protective in some instances, it is most likely under-protective in others. Major tributaries to the Housatonic River which support sport fisheries and have definite barriers to upstream migration (such as is the case in the Konkapot River) should be tested for the presence of PCBs in fish. Streams without definite barriers to upstream migration of fishes, are at a much higher risk to have some fish which contain elevated PCB concentrations.

SEDIMENTS

In response to the fish toxics monitoring data and subsequent Fish Consumption Advisory additional screening work was performed to determine the presence/absence of mercury in the sediments of the upper (above the dam at Mill River) and lower (above the dam at Ashley Falls) Konkapot River. Streambed sediments located behind dams are quite often the ultimate sink for a wide variety of environmental pollutants. Many contaminants are ubiquitous in nature and can be the result of such natural processes as forest fires, volcanic activity and microbial synthesis (Eisler 1987), however, anthropogenic activities mobilize these substances, often causing them to be enriched or concentrated above natural or baseline levels.

On 19 May 1998, three sediment samples were collected for qualitative purposes from the two sites in the Konkapot River, the results (MA DEP 1998b) of which are summarized in Table B9. Mercury was detected in both sediment samples collected in the lower watershed at Ashley Falls. Mercury was not detected in the single sample collected in the upper watershed at Mill River. Mercury exceeded the S-EL published by Persaud *et al.* (1993) in the sample collected from the depositional area at Ashley Falls. The second sample collected at Ashley Falls was at the L-EL level. Since the sediment collection method did not follow an EPA approved procedure, the results can only be used for a qualitative (not quantitative) assessment.

Table B9. 1997/1998 DEP/DWM Housatonic River Basin Survey. Sediment quality data (expressed as mg/kg dry weight unless otherwise noted) for sediment from the Konkapot River at Mill River Village, New Marlborough and Ashley Falls, MA. Threshold levels (*) extracted from Persaud *et al.* 1993, are also reported where the L-EL represents the concentration of a contaminant where no adverse impacts would be expected as well as the S-EL where the concentration would cause severe detrimental impacts to the biota.

	Lab Sample Code	TS**(%)	Al	Fe	Hg
L-EL*		NA	NA	20000	0.2
S-EL*				40000	2
Ashley Falls, depositional area, northern bank side	21-0090	53	12453	21000	2.83
Ashley Falls, erosional area, southern bank side	21-0091	60	7500	10000	0.20
Mill River, depositional area, eastern bank side	21-0092	56	9700	12000	<0.02

** total solids

The distribution and concentrations of sediment contamination are determined in part by 1) the exposure of the contaminants (in either the dissolved or bound particulate form) to the sediments from the water column and 2) the ability of the sediments to bind those contaminants. The ability of contaminants to bind with the sediment is related to a variety of factors including sediment texture (grain size), pH, and organic content.

Textural analysis provides an indirect estimate of the surface area (potential binding sites) of a sediment sample. The smaller the grain size, the more surface area and sorptive potential for soluble ions. The majority of the sediments in the Konkapot River are sandy, coarse grained; these are not conducive to binding contaminants.

The availability of binding sites in the sediment is also determined in part by pH. The higher the pH, the more the binding sites become available for adsorption of metal hydroxides that precipitate out of the water column. In a neutral to slightly alkaline environment both the precipitation of metal hydroxides and the availability of binding sites become enhanced. The pH measurements from the Konkapot River were all above 7.0 SU, ranging between 7.2 and 8.5 SU.

LAKES

Lake synoptic survey results (MA DEP 1997c) are presented in Table B10.

TABLE B10. 1997/1998 DEP/DWM Housatonic River Basin Survey. Housatonic watershed lake status during summer 1997.

LAKE	SIZE (Acres)	TROPHIC STATE	OBSERVATIONS, Objectionable Conditions
Ashley Lake, Washington **	111	U	
Ashmere Lake, Hinsdale	217	U	non-native plants (Ms); algae on some rocks
Lake Averic, Stockbridge **	38	U	non-native plants (Ms)
Benedict Pond, Great Barrington/ Monterey	35	M	(DEM, '95)
Lake Buel, Monterey/ New Marlborough	194	E	non-native plants (Ms, Nm); algae on rocks
Center Pond, Dalton	30	U	priority organics (PCB)
Cleveland Brook Reservoir, Hinsdale **	145	U	water level down 8 feet
Cookson Pond, New Marlborough	67	U	silt on rocks, approximately 20 geese
Crane Lake, West Stockbridge	28	U	noxious plants; emergent and floating plants encroaching
Farnham Reservoir, Washington **	42	U	water level down approximately 10 feet
Lake Garfield, Monterey	262	U	
Goose Pond, Lee/ Tyringham	225	M	non-native plants (Ms, Pc; Fugro East, Inc., '95)
Greenwater Lake, Becket	88	U	non-native plants (Ms)
Hayes Pond, Otis	53	U	
Laurel Lake, Lee/ Lenox	165	E	non-native plants (Ms, Nm), algae on rocks
Long Pond, Great Barrington **	113	E	non-native plants (Ms), noxious plants; south east arm weed choked
Mansfield Pond, Great Barrington	25	E	non-native plants (Ms, Pc), noxious plants; 60% covered with very dense plants
Mill Pond, Egremont	20	E	noxious plants; 100% very dense cover
Mill Pond, Sheffield	107	E	noxious plants, algae on plants, 100% very dense cover
Onota Lake, Pittsfield/ Richmond	617	M	non-native plants (Ms, Nm, Pc), algae on bottom, approximately 100 waterfowl north of causeway

** Indicates Class A (water supply) waterbody; all others are Class B.
INFORMATION CODES:
Trophic State-- E= Eutrophic, M= Mesotrophic, U= Undetermined.
Non-native Plants-- Ms= *Myriophyllum spicatum*, Nm= *Najas minor*, Pc= *Potamogeton crispus*.

TABLE B10. Continued. 1997/1998 DEP/DWM Housatonic River Basin Survey. Housatonic watershed lake status during summer 1997.

LAKE	SIZE (Acres)	TROPHIC STATE	OBSERVATIONS, Objectionable Conditions
Plunkett Reservoir, Hinsdale	73	U	non-native plants (Ms, Nm)
Pontoosuc Lake, Pittsfield/ Lanesborough	467	U	metals (Hg), non-native plants (Ms, Nm, Pc)
Prospect Lake, Egremont	55	M	very dense submergents
Richmond Pond, Pittsfield/ Richmond	218	U	non-native plants (Ms, Nm), algal mats
Risingdale Impoundment, Great Barrington	43	U	priority organics (PCB)
Stevens Pond, Monterey	30	U	
Stockbridge Bowl, Stockbridge	382	E	non-native plants (Ms)
Thousand Acre Swamp Pond, New Marlborough	155	E	non-native plants (Ms), noxious plants; approximately 50% very dense cover
Upper Goose Pond, Lee/ Tyringham	45	M	non-native plants (Ms)
Upper Sackett Reservoir, Hinsdale **	20	U	
Windsor Reservoir, Hinsdale/ Windsor **	62	M	some algae on bottom
Woods Pond, Lee/ Lenox	122	E	noxious plants, priority organics (PCB), turbidity, extensive duckweed on surface

** Indicates Class A (water supply) waterbody; all others are Class B.
INFORMATION CODES:
Trophic State-- E= Eutrophic, M= Mesotrophic, U= Undetermined.
Non-native Plants-- Ms= *Myriophyllum spicatum*, Nm= *Najas minor*, Pc= *Potamogeton crispus*.

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APPENDIX C – DEP MACROINVERTEBRATE TECHNICAL MEMORANDUM

Subject: HOUSATONIC RIVER WATERSHED 1997 BIOLOGICAL ASSESSMENT

Submitted by: John Fiorentino, DEP/ Division of Watershed Management

Date: 15 March 1999

INTRODUCTION

Biological monitoring is a useful means of detecting anthropogenic impacts to the aquatic community. Resident biota (e.g. benthic macroinvertebrates, fish, periphyton) in a water body are natural monitors of environmental quality and can reveal the effects of episodic and cumulative pollution and habitat alteration (Plafkin *et al.* 1989, Barbour *et al.* 1995). Biological surveys and assessments are the primary approaches to biomonitoring.

As part of the Massachusetts Department of Environmental Protection/Division of Watershed Management's (MA DEP/DWM) 1997 Housatonic River watershed assessments, benthic macroinvertebrate biomonitoring was conducted to gage the biological health of various portions of the watershed. The Konkapot River was examined most intensively, with 10 sampling locations spread along its course from headwaters to mouth. Additional sampling was conducted at one station each on the Southwest and West Branches of the Housatonic River, Williams River, and Furnace Brook. On the mainstem Housatonic River and Karner Brook, sampling locations were selected as upstream/downstream pairs (results of site-specific biomonitoring activities on the mainstem Housatonic River are discussed in Szal, 1999). Sampling locations, along with station numbers and dates, are noted in Table C1. Sampling locations are shown in Figure C1.

The main objectives of biomonitoring in the Housatonic River watershed were: (a) to determine the biological health of streams within the watershed by conducting assessments based on aquatic macroinvertebrate communities; and (b) to identify problem stream segments so that efforts can be focussed on developing NPDES and Water Management Act permits, stormwater management, and control of other nonpoint source (NPS) pollution.

Specific tasks were:

1. Conduct benthic macroinvertebrate sampling at locations throughout the Housatonic River watershed.

2. Based upon the macroinvertebrate data, identify river segments within the watershed with potential point/nonpoint source pollution problems; and

3. Using the benthic macroinvertebrate data and supporting water chemistry and field data, assess the types of water quality problems that are present, and if possible, make recommendations for remedial actions.

Table C1. List of macroinvertebrate biomonitoring station locations for the 1997 Housatonic River watershed survey, including station number, station description, and sampling date.

STATION	SITE DESCRIPTION	SAMPLINGDATE
KR01	Konkapot River, dnst fr. Route 7, Ashley Falls MA	25 August 1997
KR02	Konkapot River, upst fr. Route 124, North Cannan CT	25 August 1997
KR03	Konkapot River, dnst fr. Old Turnpike North, North Canaan CT	25 August 1997
KR05	Konkapot River, upst fr. Konkapot Rd., New Marlborough MA	25 August 1997
KR06	Konkapot River, dnst fr. Umpachene Falls Rd/Umpachene River, New Marlborough MA	25 August 1997
KR07	Konkapot River, dnst fr. Mill River village and Southfield Rd., New Marlborough MA	27 August 1997
KR08	Konkapot River, upst fr. Hartsville Mill River Rd., New Marlborough MA	26 August 1997
KR09	Konkapot River, dnst fr. Lake Buel Rd., New Marlborough MA	26 August 1997
KR11	Konkapot River, dnst fr. Route 23, Monterey MA	26 August 1997
KR12	Konkapot River, dnst fr. Beartown Mountain Rd., Monterey MA	26 August 1997
WR01	Williams River, upst fr. Route 41, Great Barrington MA	27 August 1997
FB01	Furnace Brook, dnst fr. Furnace Rd., Richmond MA	27 August 1997
KB01	Karner Brook, off Mt. Washington Rd., upst fr. Pumphouse, Egremont MA	26 August 1997
KB02	Karner Brook, off Mt. Washington Rd., dnst fr. Pumphouse, Egremont MA	26 August 1997
HW02S	Southwest Branch Housatonic River, dnst fr. Barker Rd., Pittsfield MA	27 August 1997
HW01	West Branch Housatonic River, dnst fr. Route 20, Pittsfield MA	27 August 1997
HR05*	Housatonic River, upst fr. Great Barrington WWTP, Great Barrington MA	25 August 1997
HR06*	Housatonic River, dnst fr. Great Barrington WWTP, Great Barrington MA	25 August 1997
HR03*	Housatonic River, upst fr. Schweitzer-Mauduit, Lee MA	25 August 1997
HR04*	Housatonic River, dnst fr. Schweitzer-Mauduit, Lee MA	25 August 1997

*bioassessments for these stations are discussed by Szal (1999) in a separate technical memorandum in Appendix D of this report

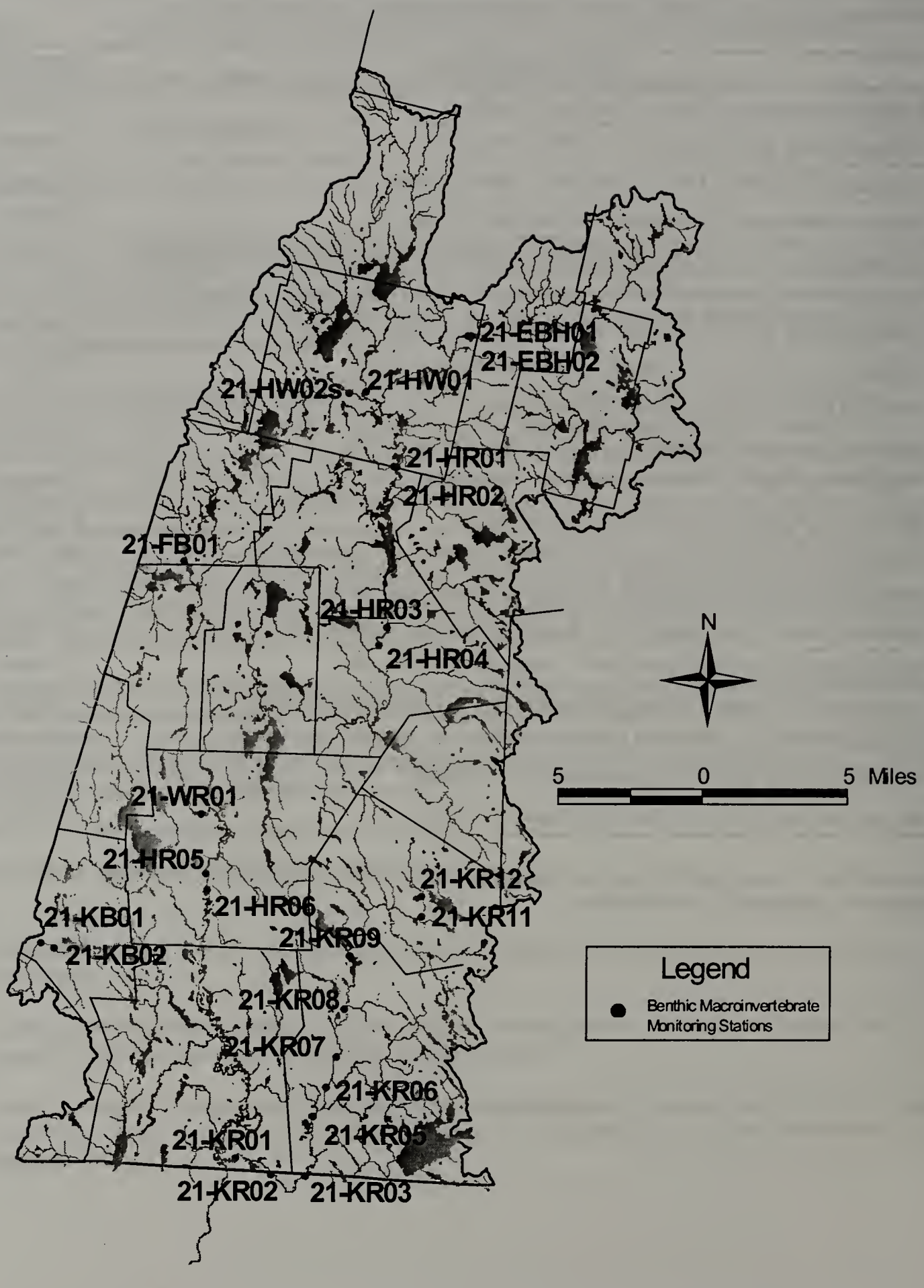

Figure C1. Location of DWM macroinvertebrate biomonitoring stations sampled during the 1997 Housatonic River watershed survey.

METHODS

Macroinvertebrate sampling and processing procedures are described in detail in the benthos monitoring SOP (Nuzzo 1999) but a brief description will be given here. Sampling was conducted throughout a 100 m reach, in riffle/run areas with fast currents and cobble/gravel substrates—generally the most productive habitats, supporting the most diverse communities in the stream system. Ten kicks in squares approximately 0.46 m x 0.46 m were composited for a total sample area of about 2 m^2. Samples were preserved in the field with denatured 95% ethanol, then brought to the DWM lab for processing. When possible, qualitative periphyton samples were taken concurrent with macroinvertebrate sampling, providing additional biological information at each station. Periphyton sampling was typically performed in open-canopy riffle areas. The algal collection procedure consisted of scraping hard substrates with a knife and collecting the material in a labeled glass vial. Samples were kept in an iced cooler and transported to the DWM laboratory for identification. Before leaving the sample reach, habitat qualities were scored using a modification of the evaluation procedure in Plafkin *et al.* (1989). The habitat assessment is intended to support the biosurvey and enhance the interpretation of the biological data. The matrix used to assess habitat quality is based on key physical characteristics of the water body and surrounding land use. Most parameters evaluated are instream physical attributes often related to overall land use and are potential sources of limitation to the aquatic biota (Plafkin *et al.* 1989). The ten habitat parameters are as follows: instream cover, epifaunal substrate, embeddedness, sediment deposition, velocity/depth combinations, channel flow status, right and left (when facing downstream) bank vegetative protection, right and left bank stability, right and left bank riparian vegetative zone width. Habitat parameters are scored, totaled, and compared to a regional reference station and/or a site-specific control (upstream reference) station to provide a final habitat ranking.

Macroinvertebrate sample processing entailed distributing a sample in pans, selecting grids within the pans at random, and sorting specimens from the other materials in the sample until approximately 100 organisms (±10%) were extracted. Specimens were identified to genus or species as allowed by available keys, specimen condition, and specimen maturity. Taxonomic data were analyzed using a modification of Rapid Bioassessment Protocol III (RBP III) metrics and scores (Plafkin *et al.* 1989). Based on the taxonomy various community, population, and functional parameters, or "metrics" were calculated which allow an investigator to measure important aspects of the biological integrity of the community. This integrated approach provides more assurance of a valid assessment because a variety of biological parameters are evaluated. Deficiency of any one metric should not invalidate the entire approach (Plafkin *et al.* 1989). Metric values for each station were scored based on comparability to the reference station, and scores were totaled. The percent comparability of total metric scores for each study site to those for a selected unimpaired reference station (i.e. "best attainable situation") yields an impairment score for each site. RBP III analysis separates sites into four categories: non-impaired, slightly impaired, moderately impaired, and severely impaired. Impairment of the benthic community may be indicated by the absence of generally pollution-sensitive macroinvertebrate taxa such as Ephemeroptera, Plecoptera, and Trichoptera (EPT); dominance of a particular taxon, especially the pollution-tolerant Chironomidae and Oligochaeta taxa; low taxa richness; or shifts in community composition relative to the reference station (Plafkin *et al.* 1989). Those biological metrics calculated and used in the analysis of Housatonic River watershed macroinvertebrate data are listed and defined below. For a more detailed description of metrics used to evaluate benthos data see Plafkin *et al.* (1989):

1. Taxa richness—a measure based on the number of taxa present. The lowest possible taxonomic level is assumed to be genus or species.

2. EPT Index—a count of the number of genera/species from the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). As a group these are considered three of the more sensitive aquatic insect orders. Therefore, the greater the contribution to total richness from these three orders, the healthier the community.

3. Biotic Index—based on the Hilsenhoff Biotic Index (HBI), is an index designed to produce a numerical value to indicate the level of organic pollution. Organisms have been assigned a value

ranging from zero to ten based on their tolerance to organic pollution. A value of zero indicates the taxon is highly intolerant of pollution and is likely to be found only in pollution-free waters. A value of ten indicates the taxon is tolerant of pollution and may be found in highly polluted waters. The number of organisms and the individually assigned values are used in a mathematical formula that describes the degree of organic pollution at the study site. The formula for calculating HBI is:

$$HBI = \sum \frac{x_i t_i}{n}$$

where

x_i = number of individuals within a taxon

t_i = tolerance value of a taxon

n = total number of organisms in the sample

4. Ratio of EPT and Chironomidae Abundance—The EPT and Chironomidae abundance ratio uses relative abundance of these indicator groups as a measure of community balance. Skewed populations having a disproportionate number of the generally tolerant Chironomidae relative to the more sensitive insects groups may indicate environmental stress.

5. Percent Contribution Dominant Taxon—is the percent contribution of the numerically dominant taxon (genus or species) to the total numbers of organisms. A community dominated by few species indicates environmental stress. Conversely, more balance among species indicates a healthy community.

6. Ratio of Scraper and Filtering Collector Functional Feeding Groups—this ratio reflects the community food base. The proportion of the two feeding groups is important because predominance of a particular feeding type may indicate an unbalanced community responding to an overabundance of a particular food source (Plafkin *et al.* 1989).

7. Community Similarity—is a comparison of a study site community to a reference site community. Similarity is often based on indices that compare community composition. Most community similarity indices stress richness and/or richness and abundance. Generally speaking, communities will become more dissimilar as stress increases.

RESULTS AND DISCUSSION

The taxonomic list of macroinvertebrates collected at each sampling station is attached as an appendix (Appendix A). Table C-A1 includes the genus/species level taxonomic list of macroinvertebrates from all stations sampled in the Konkapot River, while Table C-A2 is a genus/species level taxonomic list of macroinvertebrates collected from select tributary and mainstem stations. Included in both taxa lists are total organism counts, and the functional feeding group (FG) and tolerance value (TV) of each taxon.

Summary tables of the RBP III data analyses, including biological metric calculations, metric scores, and impairment scores, are included in Appendix B. Table C-B1 is the summary table for all Konkapot River stations, using KR11 as the regional reference station. Table C-B2 is the summary table for additional tributary and mainstem stations when compared to the regional reference station KR11. Table C-B3 is the summary table for Karner Brook stations, where the assessment was based on

upstream/downstream (i.e. site-specific) comparisons; thus, bracketing a known stressor. Habitat assessment scores for each station are also included in the summary tables, while a more detailed summary of habitat parameters evaluated is shown in Table C-B4.

The benthic macroinvertebrate data for this watershed generally indicate healthy aquatic communities and good habitat in the tributary streams examined, but likely problems in the Housatonic River.

KONKAPOT RIVER

The Konkapot River runs from the outlet of Brewer Lake in Monterey, Massachusetts in a generally southwesterly direction through New Marlborough before making a short loop through North Canaan, Connecticut and reappearing in Massachusetts flowing in a more or less westerly direction along the southern edge of Sheffield, Massachusetts. It empties into the Housatonic River at Ashley Falls, about 300 m upstream from the Connecticut state line. There were ten monitoring locations along the Konkapot River. Though numbered from mouth to headwaters (Table C1) the stations will be discussed from headwaters to mouth.

KR12—Konkapot River, downstream from Beartown Mountain Road, Monterey, MA.

HABITAT

Brewer Lake is a small impoundment nestled between Tyringham Road (and the outlet of Lake Garfield) and Beartown Mountain Road. The Konkapot River emerges from Brewer Lake as a fairly straight channel less than 100 m upstream from Beartown Mountain Road. The top of the reach sampled was approximately another 50 m downstream from the road and the Konkapot's confluence with Loom Brook. The riparian zone on the east bank consisted of back yard lawns for two adjacent houses, which may be a source of NPS inputs (e.g. lawn runoff, grass clippings and other yard waste) to the reach; the zone on the west bank was forested, dominated by maples with some hemlocks farther from the stream. The riffle habitat within the sample reach was judged to be good, with excellent (score: 19/20) epifaunal substrates and well developed riffles and runs—though these were all quite shallow (score: 12/20). The composite habitat score was 138/200, the third lowest score received by a Konkapot River biomonitoring station (Table C-B4). The individual scores that make up the composite indicate that the greatest habitat limitations were related to the low volume of water and to sediment deposition. Depositional bars, and associated instream embeddedness were common throughout the sampling reach.

BENTHOS

This station would have been the obvious choice for a reference station for the Konkapot River given its location in the watershed (i.e. most upstream station in the sub-basin, and presumably upstream from most anthropogenic impacts). However, low richness and high Hilsenhoff biotic index (HBI) values relative to the other Konkapot River stations indicated it might not be the best choice for representing unimpaired or "best attainable conditions." When compared to the selected reference station (see "KR11" below) the total metric score for KR12 was only 62% comparable—a result that places this site in the slightly impaired category (Table B1). Metrics most affecting the impairment score were the scraper/filterer and percent dominant taxon values—the result of a community dominated by the filter-feeding caddisfly *Chimarra* sp. This probably relates to the influence of upstream impoundments and not the direct impact of pollutants. Typically, in lentic systems such as the impoundments upstream, the primary source of organic matter is autochthonous (produced within the system), with secondary inputs of allochthonous (transported into the system from someplace else) materials from shoreline vegetation and fluvial inputs (Wetzel 1975, Merritt *et al.* 1984). Phytoplankton production—and to a lesser extent, littoral vascular plant production—and associated dissolved organic matter (DOM), are the primary source of autochthonous matter (Wetzel 1975). It is the physical-chemical flocculation (nonbiological) of this DOM and/or other biological processes which

leads to the formation of FPOM, the primary nutrition resource utilized by filter-feeders such as *Chimarra* sp. who use silken nets to capture this food resource as it is suspended in the water column (Wetzel 1975). While FPOM production in lotic systems is primarily a result of the processing of microbially colonized Course Particulate Organic Material (CPOM) by aquatic shredders, the high concentration of FPOM in stream systems immediately below pond and reservoir outlets has mainly lentic origins. If these lentic systems are subjected to increasingly eutrophic conditions the resulting effects of enrichment (i.e. increased algal, plant, and DOM production) can be seen not only in the lentic fauna, but also the aquatic communities immediately downstream. The filter-feeding invertebrate assemblage at KR12 appears to reflect the effects of only mild upstream enrichment, as some of the metrics for this site (e.g. EPT index, EPT/Chironomidae) scored quite well relative to reference conditions (Table C-B2).

It is also possible that the habitat limitations noted above are reflected in the relatively poor performance of this assemblage. For instance, the sedimentation problems and flow status very well could be fallout from construction of the upstream dam and outfall channel. The HBI, although higher than the reference station, was still relatively low. For this reason it is likely that habitat factors (especially those related to sedimentation) are limiting the potential of the benthic community at this site. Sand and other fine sediments drastically reduce macroinvertebrate microhabitat by filling the interstitial spaces of substrates. Reduced substrate microhabitat due to embeddedness and sediment deposition may threaten the resident EPT community at KR12, as these forms may be susceptible to increases in sediment loading due to their inability to burrow (Johnson *et al.* 1993).

KR11—Konkapot River, downstream from Route 23 and Bidwell Park, Monterey, MA.

HABITAT

From KR12 the Konkapot River flows south, crossing Route 23 in the center of Monterey village. The stream then flows behind the shops along the south side of Route 23, over a concrete dam, then makes a large "horseshoe" loop around Bidwell Park, flowing northwesterly for a short distance before veering off in a southwesterly direction. The sample reach was located below the loop, a total of approximately 300 m downstream from Route 23. The land on both sides was forested, forming a closed canopy over the stream. Instream substrates (score: 18/20) and flow status (score: 19/20) through this reach of the river were very favorable for the benthic macroinvertebrate community. The effects of sedimentation appeared to be minimal (score: 18/20). The river banks within the reach were well vegetated (score: 10/10) with ferns, mosses and horsetail (*Equisetum* sp.), and the undisturbed riparian zone (mostly hemlocks and maple) width exceeded 18 m (score: 10/10). The composite habitat score was 180/200—the highest score received by a biomonitoring station in the Konkapot River watershed (Table C-B4). KR12 was designated a regional reference station for the Housatonic River watershed biomonitoring survey by virtue of its high habitat evaluation and minimal upstream/adjacent land use impacts (e.g. absence of point source inputs, lack of channelization, minimal development and agricultural activity nearby, undisturbed and well vegetated riparian zone).

BENTHOS

Besides offering exceptional habitat, this reach of the stream was characterized by a macroinvertebrate assemblage indicating a very healthy aquatic community. Thirty different taxa were counted and most of the metric values were strongly indicative of clean water and "best attainable conditions" (Table C-B1). In particular, those parameters (although an EPT index of 8 was somewhat lower than expected) that measure components of community structure—which display the lowest inherent variability among the RBP metrics used (Resh 1988)—scored well, further corroborating the designation as a reference station.

KR09—Konkapot River, downstream from Lake Buel and Hartsville-Mill River Road, New Marlborough, MA.

HABITAT

From Monterey the Konkapot River flows southwest into New Marlborough. Within a few miles it receives discharge from the Lake Buel outlet channel, about 50 m upstream from Hartsville-Mill River Road. The top of the sample reach was about 100 m downstream from the road crossing. The banks were high above the water's surface (1-3 m). Sloughing at points along the banks provided evidence of the pressures that result in meandering through a flood plain comprised of naturally sandy soils. The erosion and collapse of the banks also accounts for the deposition of sand and gravel on old and new bars within the sample reach. The vegetative (purple loosestrife, goldenrod, ferns, rose) bank protection was very good in spite of the areas of collapse. The buffer zone beyond the stream's west bank was forested (maple, white pine, ash), while a thin zone of trees (ash) and shrubs (riverbank grape) buffered the stream from an open field (apparently not used for crops at that time) to the east. The canopy was mostly open. *Elodea* sp. was common instream, as were filamentous algae (*Hormidium* sp. dominated). Riffles were scattered through the reach but tended to be shallow and not very well developed (score: 12/20). The bottom substrate tended to be mostly gravel, with little cobble (score: 11/20). The composite habitat score (score: 119/200) for this site was the lowest among the Konkapot River sites (Table C-B4).

BENTHOS

In spite of the relatively poor habitat score the benthos data indicate a healthy aquatic community. The macroinvertebrate assemblage was rich in taxa (31) and evenly distributed among taxa (dominant taxon was 13% of the total). The HBI was fairly low (4.36) and the EPT index was comparable to the reference. The overall assessment score indicated this site was non-impaired based on a total metric score that was 86% comparable to KR11 (Table C-B1).

KR08—Konkapot River, upstream from Hartsville-Mill River Road (north of New Marlborough Hill Road), New Marlborough, MA.

HABITAT

Moving downstream from KR09 the Konkapot River flows in an overall southerly direction, crossing Hartsville-Mill River Road again, just before its intersection with New Marlborough Hill Road. The reach just upstream from the road offered excellent habitat for aquatic macroinvertebrates. Fast-flowing shallow (though more than adequately deep) water dominated, as did coarse rocky substrates (scores: 13/20 and 20/20, respectively). The channel was wide enough that the canopy was mostly open, allowing for an abundance of instream algal cover. Both stream banks were stable and well vegetated. A wide pine-dominated riparian zone extended undisturbed from the left (east) bank, while the right (west) zone provided only minimal buffer from the backyard of an adjacent residence. The composite habitat score was 154/200 (Table C-B4).

BENTHOS

KR08 received a total metric score of 34, representing 81% comparability to reference conditions. Dominance by a single taxon in excess of 20% of the total, lower EPT/Chironomidae abundance ratio relative to the reference, and low similarity to the species and abundances of the reference all reduced the composite metric score sufficiently to place the determination for this site in the gray area between non-impaired and slightly impaired (Table C-B1). This marginal difference relative to KR11 may simply be due to habitat differences, but could be from the influence of the extensive wetland stretch (as shown on the USGS topographic map), or an early indication of enrichment from undetermined sources (e.g., septic systems, agricultural activities). Enrichment effects appear to be minimal at most, as the scraper/filterer metric scored well and precludes the overabundance of the FPOM food resource one would expect to find in an excessively enriched system. However, an abundance of filamentous green algae and erect diatoms (*Hormidium* sp., *Melosira* sp., *Synedra* sp., *Tabellaria* sp.,

Cocconeis sp.)—whose presence is often associated with organic enrichment—was observed throughout the KR08 sampling reach.

KR07—Konkapot River, downstream from Mill River-Southfield Road, New Marlborough, MA.

HABITAT

From KR08 the Konkapot River continues its southerly course, passing through the village of Mill River. Station KR07 was located approximately 900 m downstream from Mill River-Southfield Road, adjacent to Clayton-Mill River Road. This was a fast-flowing reach with substrates that were mostly bedrock, boulder, and cobble. The flow characteristics (score: 18/20) and excellent epifaunal substrates (score: 20/20) contributed to a high aggregate habitat score of 171/200 (Table C-B4). Both stream banks were well vegetated and stable, with a particularly wide and forested (hemlock/maple with fern-dominated understory) riparian zone along the left (east) bank. The riparian zone along the right (west) bank, however, provided a very narrow buffer from the adjacent road. Runoff from this road may be partially responsible for occasional areas of sediment deposition observed in the sampling reach and may be exacerbated by the steepness of the right (west) bank.

BENTHOS

The overall total score (34; 81% comparable to KR11) for the metrics at this site also bordered the non-impaired and slightly impaired categories (Table C-B1). The point losses occurred with the HBI, percent dominant taxon, and percent similarity—the result of a numerical dominance of more tolerant taxa. As with KR08 this biological assessment may be an early indication of a developing problem. That overall habitat quality and flow regimes at KR07 are comparable to reference conditions at KR12 indicates that detected impacts to resident benthos may be attributed to water quality problems (e.g. organic enrichment), perhaps originating in the vicinity of Mill River village.

KR06—Konkapot River, downstream from Umpachene River, New Marlborough, MA.

HABITAT

Continuing in a south-southwesterly direction the Konkapot River crosses Hadsell Street (a.k.a. Umpachene Falls Road) before receiving flow from the Umpachene River. The sample reach was approximately 340 m downstream from the Umpachene River confluence, about 620 m downstream from the road, and running closely adjacent to Clayton-Mill River Road. The epifaunal substrate in this reach was about 60% bedrock, with the remaining 40% comprised of cobble and boulder (score: 17/20). There was a good variety of water depth and velocity patterns, with well developed riffles and runs throughout (score: 20/20). Much like KR07, the left (east) bank offered an undisturbed hemlock and pine-dominated riparian zone, while the right (west) bank was only minimally buffered from the adjacent road with maples and herbaceous growth (ferns, purple loosestrife, riverbank grape). Overall the habitat was judged to be excellent for invertebrates and fish, with a total score of 178/200 (Table C-B4)—one of the highest assessment scores received by a Konkapot River station.

BENTHOS

Though the assemblage of macroinvertebrates was not very similar to the reference in terms of kinds and relative densities (percent-similarity index: 38%), the total score of the metrics indicated no impairment to aquatic life (90% comparable to reference station). In fact, this station supported one of the most diverse assemblages of pollution-sensitive taxa in the entire Housatonic River watershed, with taxa richness and EPT index metric values higher than the reference community at KR11 (Table C-B1).

KR05—Konkapot River, upstream from Konkapot Road, New Marlborough, MA.

HABITAT

The Konkapot River covers approximately 2 km as it flows southwesterly between KR06 and KR05. The sample reach extended upstream from Konkapot Road to an area of shallow water flowing over bedrock or rock slabs. The stretch upstream from this was flat water. Remnants of mill structures were present on each bank (buttresses for a dam?). The riparian zone along the northwest bank was mostly mowed lawns of an adjacent housing subdivision, while the southeast bank and riparian zone was mostly wooded (maple, elm, beech) and undisturbed. Goldenrod, purple loosestrife, and horsetail were observed along the margins of both banks. The epifaunal substrate was mostly bedrock, boulder, and cobble (score: 20/20) in well developed riffles and runs. There was a variety of water depths and velocities within the reach (score: 20/20). Overall habitat quality of this reach scored 172/200 (Table C-B4).

BENTHOS

KR05 received a total metric score of 36, representing 86% comparability to the "best attainable conditions" of KR11. Although the HBI for this site was enough higher than the reference to reduce its score (4/6) the overall metric score indicated that this site is non-impaired (Table C-B1). Other measures of community structure (taxa richness, EPT index) were as good as, or better than, those for KR11.

KR03—Konkapot River, downstream from Old Turnpike North, North Canaan, CT.

HABITAT

The Konkapot covers approximately 5 km along its southerly course before crossing into Connecticut and flowing under Old North Turnpike in North Canaan. The sample reach was just downstream from Old North Turnpike. The epifaunal substrates were excellent (20/20), consisting mainly of cobble and boulders in well developed riffles and runs. The velocity and depth combinations within the reach were also excellent (20/20). A dense pine forest extended from the stable and well vegetated (goldenrod, ferns, riverbank grape, grasses) left (south) bank, while occasional oaks and willows provided some vegetative buffer from the encroaching lawn along the right (north) bank. The overall aquatic habitat assessment received a score of 177/200 (Table C-B4). The Old North Turnpike crossing provided potential NPS inputs in the form of runoff, although instream deposition and embeddedness were minimal throughout the reach.

BENTHOS

KR03 received a total metric score of 36, representing 86% comparability to reference conditions. At this site too, the HBI was different enough from the reference to reduce its score (4/6), but the composite metric score indicated KR03 is in the non-impaired category (Table C-B1). Most of the metric values were similar to, or better than, those calculated for the reference station.

KR02—Konkapot River, upstream from Route 124, North Canaan, CT.

HABITAT

From Old Turnpike North the Konkapot River flows southwesterly, at first, crossing Allyndale Road in the village of Sodom and then starting on a northwesterly course that again intersects the state line. Station KR02 was approximately 3.5 km downstream from KR03, just upstream from Route 124 and the point where the river flows back into Massachusetts. The gradient of the river channel is obviously less than in the upper reaches but the short segment upstream from Route 124 offered the coarse substrates (score: 16/20) and fast-flowing-water environment (score: 16/20) required for the benthic

analysis. These attributes were overshadowed, however, by the deposition of fine sediment materials around the coarser substrates. This was largely responsible for the low overall habitat score for this site (123/200). Agricultural land uses appeared to dominate in this portion of the river (KR03 to KR02). Agricultural activities adjacent to the sampling reach were only minimally buffered by herbaceous growth (goldenrod, riverbank grape, purple loosestrife) and a few trees. The canopy was open, providing ample sunlight penetration to support a luxuriant algal (diatoms and filamentous greens) community throughout the sampling reach.

BENTHOS

KR02 received a total metric score of 32, representing a 76% comparability to reference conditions. Though the assemblage of benthic macroinvertebrates appeared to represent a rich and well balanced fauna, the proportion of midges (Chironomidae) increased considerably—suggesting the effects of organic and/or nutrient enrichment, and corroborated by the dense algal (*Ulothrix* sp., *Spirogyra* sp., *Fragilaria* sp.) growth and heavy instream deposits of FPOM throughout this portion of the river. These fine materials can be deleterious because they can reduce light penetration and consequently plant growth (instream aquatic vegetation was minimal at KR02), smother hard surfaces, and fill interstices within the substrate (Wiederholm 1984). Resident biota at KR02, then, may be subsequently affected by obstructions in food collection or respiration caused by fine deposits of organic material. The drop in the abundance ratio of EPT to Chironomidae relative to the reference station was sufficient to reduce the score on this metric to 2/6. This, along with the very low similarity to the reference community taxa list, caused the composite score (32/42) to fall into the slightly impaired category (Table C-B1). Although this is not an alarming result it probably is an indication that review of land management practices to control nonpoint source contamination, and fine sediment loading in particular (as evident from the habitat assessment), is a good idea. Water quality monitoring conducted by DWM during the 1997 watershed survey revealed elevated levels (160 – 2000 cfu/100 ml) of fecal coliform bacteria at KR02, suggesting that water quality here may indeed be suspect.

KR01—Konkapot River, downstream from Route 7A (Ashley Falls Road), Sheffield, MA.

HABITAT

From KR02 the Konkapot River meanders another 3.5 km (approximately)—northwesterly at first, then mostly west—before flowing under Route 7A and over a high dam in the village of Ashley Falls. Immediately downstream from the dam were some deep pools, then about 30 m of fast flowing water over mostly cobble and boulder substrates—with sandy deposits along the margins. The gradient quickly flattened out such that from there to the confluence with the Housatonic River, the remainder of the Konkapot River was a slow moving, sandy-bottomed river, with some deep pools at its bends. The kick-samples were taken in the reach just below the dam where the epifaunal substrates (score: 16/20) and flow characteristics were good (score: 18/20). Instream sedimentation observed throughout the reach probably is the result of sediment inputs from the upstream road crossing, as well as naturally sandy floodplain soils in this portion of the watershed. The riparian zone along both banks was well vegetated with hardwood trees, as well as herbaceous growth (riverbank grape, ferns, grasses, green briar) throughout the floodplain. The overall habitat score was 172/200 (Table C-B4).

BENTHOS

The benthic community at KR01 yielded the highest HBI (4.92) of the Konkapot River stations, indicating the most pollution tolerant assemblage. Deviation from the reference station HBI was enough to reduce the score for this metric (4/6). None of the sampling locations produced an assemblage of macroinvertebrates with a high similarity to the reference assemblage, but KR01's similarity was so low that it scored a 0/6. The total metric score (34) was 81% of the reference, placing the bioassessment in the gray area between non- and slightly impaired (Table C-B1). Though not yet indicative of a serious problem it should serve as an alert to the need to review land management practices to minimize sediment and nutrient loading to the lower Konkapot River. The dominance of the macroinvertebrate assemblage by the filter-feeding Hydropsychidae (Table C-A1),

and dense filamentous algal (*Spirogyra* sp., *Melosira* sp., *Tabellaria* sp.) cover throughout the reach, is indicative of FPOM-rich conditions that may be the result of nutrient loadings to this system. Water quality monitoring conducted by DWM during the 1997 watershed survey revealed elevated levels (as high as 820 cfu/100 ml) of fecal coliform bacteria at KR01, suggesting that water quality here may indeed be suspect.

KONKAPOT RIVER SUMMARY

- Generally high quality waters throughout
- KR12 and KR02 both lost points in their overall habitat score because of problems related to instream sedimentation. In addition, water quality problems may exist at KR02 as well.
- KR12 and KR02 were the only stations to score in the slightly impaired category, though three others (KR01, KR07, KR08) scored between the non-impaired and slightly impaired categories. Additional monitoring (bacteria) by DWM at KR07 and KR01 indicate water quality may be suspect here.

TRIBUTARIES (WILLIAMS RIVER, FURNACE BROOK, KARNER BROOK)

A major tributary of the Housatonic River, the Williams River originates at the outlet of Shaker Mill Pond in West Stockbridge. The river flows in a southerly direction for most of its length before joining the mainstem just downstream from Route 41 in Great Barrington. The Williams River drains a predominantly undeveloped area of mostly forested space. There is occasional agricultural activity in the sub-basin as well, particularly as the river approaches the flood plain of the Housatonic River. The river also receives treated effluent from the West Stockbridge POTW. Macroinvertebrate biomonitoring was conducted just upstream from Route 41 not far from the confluence with the mainstem Housatonic River. The bioassessment of the Williams River station was made based on comparisons to the benthos community at KR11.

From its headwaters in the Taconic Range near the Massachusetts-New York border, the third- order Furnace Brook flows in a southerly direction before receiving considerable drainage from Cone Brook near Route 41 in Richmond. From here the stream continues south until it reaches the inlet of Mud Ponds/Shaker Mill Pond (source of Williams River) in West Stockbridge. The majority of the Furnace Brook sub-basin drains undeveloped open spaces of forest and wetland; Residential and commercial development is very minimal. Macroinvertebrate biomonitoring was conducted just downstream from Furnace Road, approximately 1.0 km from the inlet to Mud Ponds. The bioassessment of the Furnace Brook station was made based on comparisons to the benthos community at KR11.

Karner Brook is a small, second-order stream that originates in Mount Washington State Forest. This high-gradient stream closely parallels Mount Washington Road, receiving the flow of a few small tributaries before discharging to Mill Pond (source of the Housatonic River tributary Hubbard Brook) in Egremont. Macroinvertebrate biomonitoring was conducted both upstream and downstream from a privately owned pumping station located approximately 1.5 km upstream from Jug End Road in Egremont. Sampling was conducted here in 1992 by MA DEP (1993) as part of the Housatonic River Tributary Biomonitoring Survey, which investigated the effects that surface water withdrawals have on downstream aquatic communities. The 1992 assessment of Karner Brook—based on RBP II protocols (i.e. family level taxonomic identification)—indicated a potential (non-impacted/borderline-impacted) problem, and recommended additional monitoring be conducted at the RBP III level. RBP III offers a more rigorous assessment of biological data, and allows detection of more subtle degrees of impairment to the aquatic community. By increasing the level of taxonomic resolution; that is, by performing taxonomic identifications to the lowest practical level (genus/species), the ability to discriminate levels of impairment is greatly enhanced. Site-specific monitoring was the only sampling approach taken to assess biological quality in Karner Brook; that is, biological assessments of the Karner Brook stations were not made based on comparisons to the macroinvertebrate community at KR11. The site-specific approach is more appropriate for an assessment of an impact site

downstream from a known (or perceived) stressor (Plafkin *et al.* 1989). Differences in drainage area, as well as riparian and instream characteristics made additional comparisons between KR01/KR02 (closed canopy, shredder/CPOM-dominated) and KR11 (partially closed canopy, grazer/periphyton dominated) inappropriate. Since both the quality and quantity of available habitat affect the structure and composition of resident biological communities, effects of such features can be minimized by sampling similar habitats at all stations being compared (Plafkin *et al.* 1989). Sampling highly similar habitats will also reduce metric variability, attributable to factors such as current speed and substrate type. Furthermore, unless basically similar physical habitat is sampled at all stations, community differences attributed to a degraded habitat will be difficult to separate from those resulting from water quality degradation. The discrepancy in habitat, then, between Karner Brook and the Konkapot River stations would probably be reflected in the invertebrate assemblages found there as well; yet, it would be impossible to determine whether water quality or habitat quality was limiting to the biological integrity of the study site.

WR01—Williams River, Upstream from Route 41, Great Barrington, MA.

HABITAT

The WR01 sampling reach began just upstream from Route 41 and extended upstream to Division Street in Great Barrington. The reach was comprised of a variety of fast-water flow regimes (score: 20/20) interspersed with deep pools, offering excellent habitat for macroinvertebrates and fish. An abundance of log jams, snags, and other woody debris provided additional cover for fish throughout the reach. Kick sampling was conducted in a variety of rocky epifaunal substrates (score: 20/20), including cobble, gravel, and boulder (larger substrates required surface rubbing by hand)—all found in riffles of varying depths. Banks were generally well vegetated and stable, although signs of erosion were observed along the steeper portions of the left (north) bank near the top of the reach. Riparian vegetation consisted of a mix of hardwoods (maple, ash, sumac) and conifers (white pine), with a layer of herbaceous growth (goldenrod, jewelweed, riverbank grape) along the channel margins. Instream vegetation was fairly minimal and dominated by filamentous forms of green algae (*Cladophora* sp., *Spirogyra* sp.). WR01 received a total habitat assessment score of 169/200 (Table B4). Two houses were located at the top of the steep left (north) bank, with the more upstream of the two apparently the source of trash deposits along the bank near the top of the reach. A large pile of trash, which included car parts, scrap metal, glass, and empty drums, was also observed along the right (south) bank near the Route 41 crossing.

BENTHOS

The macroinvertebrate assemblage sampled at WR01 appears to reflect the diverse and excellent instream habitat found there. Taxa richness (31) and EPT index (12) values were higher than those of the "best attainable conditions" at KR11, and HBI was only slightly higher (still scoring 6/6). In addition, high scores (6/6) for the scraper/filterer metric and percent contribution of dominant taxon metric indicated balance of the community and food resources. WR01 received a total metric score of 38, which was highly comparable (90%) to the reference community and indicative of non-impaired conditions (Table C-B2). NPS pollution in the form of trash, apparently being dumped from the road crossing (especially near the Route 41/Division Street intersection) and an adjacent house along the left (north) bank, threaten biological integrity at WR01. While instream deposits of trash were not observed, the steep and herbaceous nature of portions of the WR01 stream banks may not provide an adequate buffer from these NPS inputs over time.

FB01—Furnace Brook, downstream from Furnace Road, Richmond, MA.

HABITAT

The FB01 sampling reach began just upstream from Furnace Road, in a relatively undeveloped portion of the sub-basin. The reach meandered through a dense forest, with typical flood plain vegetation (ferns, grasses, goldenrod, riverbank grape) giving way to maples, ash, beech, and hemlock trees further from the stream. The closed-canopy nature of the stream reach most likely precluded significant cover of aquatic vegetation and algae, although some mosses were observed on rocky substrates. A narrow dirt road ending at a small trash-strewn clearing near the stream was the only riparian disturbance observed. An abundance of cobble and gravel in fast riffles provided excellent epifaunal habitat for macroinvertebrates (score: 20/20); however, extremely reduced flow resulted in much exposed substrate and provided minimal cover for fish (score: 10/20). The shallow nature of this small stream led to a somewhat low overall habitat evaluation relative to reference conditions at KR11. FB01 received a total habitat assessment score of 150/200 (Table C-B4).

BENTHOS

The FB01 sampling reach supported one of the most diverse macroinverebrate assemblages sampled in the Housatonic River watershed, with a taxa richness of 35. High scores (6/6) for both the EPT index metric and HBI index indicate the presence of numerous pollution-sensitive taxa as well. The dominance of the community by the chironomid *Micropsectra* sp. resulted in lower scores for the EPT/Chironomidae metric and percent dominant taxon metric. In addition, the abundance of *Micropsectra* sp.—which may display low flow adaptations (Fiorentino 1999; R. W. Bode, NY DEC, personal communication)—contributed to the low community similarity of FB01 to reference conditions at KR11, where this taxon was not well represented. Given the low-flow conditions at FB01 and the fact that the resident benthos was dominated by pollution-sensitive taxa (several species of the numerically dominant genus *Micropsectra* are highly intolerant of organic pollution), it appears that it is flow constraints—not water quality constraints—that shape the structure and function of the instream biota in Furnace Brook. FB01 received a total metric score of 30, representing 71% comparability to the KR11 assemblage. The low percent comparability to reference conditions at KR11 resulted in an assessment of slightly impaired benthos (Table C-B2). It is unknown, however, whether biological impairment is the result of naturally occurring low flows or exacerbated by the damming of an impoundment.

KB01—Karner Brook, off Mount Washington Road and upstream from pumphouse, Egremont, MA.

HABITAT

The KB01 sampling reach began immediately upstream from an unpaved driveway along Mount Washington Road, in a heavily forested portion of the watershed. The high gradient reach was dominated by rocky instream substrates of mostly cobble and boulder subjected to shallow riffles. Due to the shallow nature of this stream, many of the larger substrates and woody debris were exposed and unavailable as useful fish cover. In addition, pool habitat was extremely limited, save for a "plunge pool" at the top of the reach. Instream aquatic vegetation was absent, most likely due to the shaded nature of this sub-basin; however, aquatic mosses were common on some substrates and offered additional microhabitat for macroinvertebrates. Riparian vegetation was dominated by hemlocks on both sides of the stream, with occasional hardwoods (birch, maple, oak, ash) as well. Vegetation along the stream margins and in the understory was typical of a hemlock forest, consisting mainly of ferns. The riparian zone was virtually unlimited and undisturbed along the right (east) bank, while the proximity of Mount Washington Road to the left (west) bank was a potential source of NPS inputs. While the effects of road runoff may be exacerbated by the steepness of the left (west) bank, the flashy nature of this system probably provides ample flushing of sediment loads downstream. Neither instream sediment deposition nor embeddedness was observed at KB01. KB01 received a total habitat assessment score of 164/200 (Table C-B4). Flow constraints (velocity/depth combinations,

channel flow status) were primarily responsible for the reduced score and appear most limiting to biological integrity in this portion of the stream.

BENTHOS

Although taxa richness at KB01 was considerably lower than many of the other tributary biomonitoring stations in the watershed, headwater streams such as Karner Brook are often naturally unproductive (Plafkin *et al.* 1989)—supporting less diversity than one would expect in a clean water stream. The dominance of the KB01 assemblage by EPT taxa and other pollution-sensitive forms is reflected in a high EPT index (12) and an extremely low HBI index (1.86) (Table C-B3). In fact, the HBI calculated for the KB01 assemblage is probably one of the lowest ever observed by DWM for a biomonitoring station in Massachusetts, and is indicative of near-pristine water quality conditions; And while half of the assemblage was dominated by the chironomid *Micropsectra* sp., many species in this genus display virtually no tolerance of organic pollution. Rather, the numerical dominance of *Micropsectra* sp may suggest that habitat limitations due to flow constraints may indeed shape community structure at KB01.

KB02—Karner Brook, off Mount Washington Road and downstream from pumphouse, Egremont, MA.

HABITAT

The KB02 sampling reach began approximately 500 m downstream from KB01, and extended to within view of the pumphouse and adjacent damming structure. As with KB01, instream substrates at KB02 offered excellent (score: 20/20) epifaunal habitat for macroinvertebrates due to an abundance of cobble/boulder substrates and extensive, albeit shallow, riffle areas. Base flow, however, appeared even more reduced here than at KR01, as evidenced in lower scores for those flow-related habitat parameters (i.e. channel flow status, velocity-depth combinations, and fish cover—score: 13, 10, and 6 respectively). Reduced flow led to substantial areas of exposed cobble along the margins of the streambeds, rendering useless otherwise superb benthos habitat. Riparian vegetation (mostly hemlock with fern understory) along the KB02 sampling reach was very similar to KB01, although a house at the bottom of the reach encroached somewhat on the vegetative zone near the right (east) bank. A drainage channel apparently directs runoff from Mount Washington Road to the middle portion of the reach; however, it was dry at the time of sampling and past NPS inputs in the form of instream sedimentation were not observed. KB02 received a total habitat assessment score of 146/200 (Table C-B4).

BENTHOS

While taxa richness at KB02 was similar to the KB01 assemblage, there was a notable reduction of EPT taxa (score: 0/6). That the HBI for the KB02 assemblage was actually lower than at KB01 was the result of increased density of the chironomid *Micropsectra* sp., whose presence led to an even higher percent dominance of the community (67%) than at KB01. KB02 received a total metric score of 24, representing 67% comparability to the upstream control station and resulting in a determination of slight impairment (Table C-B3). The impairment of the KB02 benthos appears to be directly related to additional reductions in base flow due to the presence of the pumphouse and associated surface water withdrawals immediately upstream.

Flow regime and current velocity are important hydrologic determinants of benthic community structure. Flow volume and velocity/depth combinations can have effects on substrate composition and stability, the amount of channel under water, and food availability (Minshall 1984). Current plays a crucial role in the distribution of benthic macroinvertebrates—current velocity affects an organisms ability to gather food, meet respiratory requirements, avoid competition and predation, and colonize or vacate certain habitats (Minshall 1984). Short-term flow fluctuations may modify benthic communities in several ways, most notably by stranding populations in pockets of standing water or on exposed

substrates. Some EPT taxa are particularly susceptible to stranding and are relatively intolerant of exposure (Ward 1984). Flow reduction downstream of a water withdrawal may lead to the stranding of resident biota, particularly if periodic withdrawals are abrupt and substantial. In addition, decreasing discharge and the subsequent elimination of habitat or favorable flow regimes may induce "drift," or the downstream transport by current of benthic animals as a means of escape or dispersal (Wiley and Kohler 1984; Ward 1984). This taxa depletion, either by drift or the periodic loss of riffle habitat, may contribute to reduced EPT richness, and subsequent impairment at KB02. In addition, the displacement of these EPT taxa by organisms more tolerant of flow constraints (i.e. *Micropsectra* sp.), contributes to the bioassessment result: slightly impaired.

TRIBUTARY SUMMARY

- Generally high quality waters throughout.
- Habitat and biological quality appear excellent at WR01, although NPS inputs in the form of trash may threaten biological integrity. Dumping occurs along both banks.
- Water quality appears excellent at FB01 and KB01 based on the benthos sampled there, although flow-related habitat constraints may shape community structure to some degree. Slight impairment to the FB01 benthos appears related to naturally low base flows.
- Water quality appears excellent at KB01 and KB02. Naturally low flows may shape community structure at KB01. Water withdrawals may further impair habitat suitability at KB02.

HOUSATONIC RIVER (SOUTHWEST BRANCH, WEST BRANCH)

From its headwaters in Pittsfield State Forest, the Southwest Branch of the Housatonic River flows in a northeasterly direction through the West Pittsfield section of Pittsfield before merging with the West Branch of the Housatonic River near Route 20 in Pittsfield. The West Branch, which originates in Pontoosic Lake, flows in a southerly direction through highly urbanized portions of Pittsfield—one of the largest cities in western Massachusetts. After receiving additional drainage from Onota Lake, the West Branch continues in a southerly direction to its confluence with the Southwest Branch. Shortly after this merger (just downstream from Route 20), the river receives the discharge of the East Branch of the Housatonic River to become the mainstem Housatonic River. Macroinvertebrate biomonitoring was conducted at one station on the Southwest Branch and one station on the West Branch of the Housatonic River. Biological assessments were made based on comparisons of the benthos assemblage to the Konkapot River reference station (KR11).

HW02S—Southwest Branch, downstream from Barker Road, Pittsfield, MA.

HABITAT

The sampling reach began approximately 100 m downstream from Barker Road and about 0.5 mi from the confluence with the West Branch of the Housatonic River. Flow regimes were less than optimal (score: 6/20) for macroinvertebrates, with riffle areas somewhat limited. Productive benthos habitat was further reduced by substantial deposits of sand and fine organic material throughout the sampling reach. Those cobble substrates present were often unavailable to macroinvertebrates due to severe embeddedness. In addition to severe sedimentation, apparently originating from the Barker Street crossing and other upstream sources, trash (car parts, scrap metal, etc.) was another source of NPS pollution in the river. The riparian zone along both banks was well vegetated with trees (hemlock, birch, willow) and herbaceous growth (ferns, riverbank grape, grasses); however, patches of "false bamboo" and rip-rap near the top of the sampling reach were obvious signs of past anthropogenic riparian disturbances. Instream vegetation was dominated by algae, with a profusion of filamentous green algae (*Cladophora* sp.), blue-green algal mats (*Lyngbya* sp.), and diatoms (*Melosira* sp., *Navicula* sp.) covering most hard substrates in the reach. HW02S received a total habitat assessment

score of 137/200 (Table c-B4). Low scores for sediment deposition (5/20), embeddedness (8/20), and epifaunal substrate (12/20) parameters were the primary reason for the low evaluation.

BENTHOS

HW02S received a total metric score of 22, representing 52% comparability to reference conditions at KR11 and placing the benthos in the slight-moderate impairment category (Table C-B2). A reduction in pollution-sensitive EPT taxa, low similarity to KR11, and dominance of one taxon led to the low total metric score, with each of these metrics scoring 0/6. The extreme abundance (62% of the assemblage) of the grazing elmid beetle *Optioservus* sp. suggests an unbalanced community responding to an overabundant food resource (in this case, algae); however, the relatively low tolerance value of this taxon (3) and a low overall HBI (3.68) for the HW02S assemblage suggests the community is not structured in response to excessive organic pollution. In addition, dissolved oxygen levels appear sufficient enough to support the demanding respiratory requirements of *Optioservus* sp. It appears, then, that habitat quality rather than water quality is most limiting to biological integrity at HW02S. Sand and other fine-sediment loads—both organic and inorganic forms—pose the greatest threat to the benthic community here; however, inorganic nutrient loadings to this portion of the river—as reflected in the luxuriant algal community—should be considered as well. In addition, NPS pollution in the form of trash could easily be reduced with organized cleanup efforts. Sources of the habitat and/or water quality degradation observed at HW02S are most likely related to the urbanized nature of this portion of the watershed.

HW01—West Branch, downstream from Route 20, Pittsfield, MA.

HABITAT

The HW01 sampling reach began approximately 300 m downstream from Route 20, in a highly urbanized section of Pittsfield. Residential, commercial, and industrial development are prevalent forms of land use in this portion of the watershed. Both instream and riparian habitat were extremely degraded throughout the sampling reach. Epifaunal substrates (score: 11/20) and velocity/depth combinations (score: 6/20) were less than optimal for macroinvertebrates and fish due to small grain size and embeddedness of substrates, and lack of deep areas. Substantial deposits of sand and other fine sediments, including particulate organic matter, further reduced the productive benthos microhabitat and contributed to the low habitat evaluation. An abundance of bricks was observed instream, suggesting historical mill activity in this portion of the river. Various forms of trash were also observed throughout the sampling reach, and dumping of debris along the right (west) bank appeared to be a persistent problem. A narrow vegetative riparian zone (willow, maple, ash, riverbank grape) along both banks provided only minimal buffer against NPS inputs from adjacent homes, garages, and mills. Other dominant plant species (sumac, false bamboo) observed suggest anthropogenic disturbances. In addition, erosion along the left (east) bank and sediment deposits on bank vegetation indicated recent (if not regular) runoff originating from the adjacent vacant mill. HW01 received a total habitat assessment score of 107/200—by far the worst score received by a biomonitoring station in the Housatonic River watershed (Table C-B4). Dense instream algal cover (especially mats of blue-green *Lyngbya* sp. and filamentous green *Cladophora glomerata*) and moderate levels of turbidity suggest that water quality is suspect in this portion of the river as well.

BENTHOS

Community composition (taxa richness, EPT index) and similarity were low relative to the reference community at KR11. Pollution-sensitive taxa were especially lacking, leading to a score of 0/6 for the EPT index metric. In addition, a high HBI (5.64) suggests organic enrichment may contribute to impairment of the aquatic community at HW01. Indeed, significant deposits of FPOM, and a thriving algal community observed throughout the reach, are indicative of the enriched nature of this system and provide an abundant food resource for the many scrapers and filterers that make up the macroinvertebrate assemblage (Table C-A2). HW01 received a total metric score of 22, representing

52% comparability to KR11 and resulting in a determination of slight/moderately impaired (Table C-B2).

As reflected in the habitat assessment, habitat degradation is obviously limiting to biological potential at HW01, especially to those taxa (e.g. many of the EPT taxa) most susceptible to sedimentation. However, water quality impairment—most likely the result of storm water and other forms of urban runoff—appears to further degrade the aquatic community in this portion of the West Branch. Water quality of the lacustrine source water may also be a factor.

HOUSATONIC RIVER SUMMARY

- Bioassessments found impairment (slight/moderate) of the benthic community at HW02S and HW01 stations. Habitat degradation (especially sediment deposition) coupled with water quality impairment (organic enrichment, nutrient loadings) compromise biological integrity at both stations. Trash is a common source of NPS pollution at both stations, especially where dumping occurs along the right banks. HW01 received the poorest habitat evaluation of all the biomonitoring stations in the Housatonic River watershed, the result of the highly urbanized nature of this portion of the basin. HW01 and HW02S benthos were the most impaired of all the biomonitoring stations sampled during the 1997 survey.

RECOMMENDATIONS

Konkapot River—Although most of the Konkapot River biomonitoring stations reflected excellent habitat and biological integrity, NPS pollution threatens aquatic potential at some sites. Slight impairment to the KR12 benthos is probably the result of upstream impoundment effects; however, significant instream deposits were observed as well. An investigation into the sources (Beartown Mountain Road?) of sediment inputs is recommended, with the implementation of Best Management Practices (BMPs) if needed. Impairment at KR07 and KR08, while minimal, may be an early sign of developing water quality problems—possibly related to organic enrichment. Attempts should be made to isolate potential sources of water quality impairment in the vicinity of Mill River village. Runoff from adjacent lawns is a potential source of nutrient loadings to KR08, although unknown sources upstream may exist as well. Runoff from the adjacent road may be partially responsible for occasional areas of sediment deposition observed in the KR07 sampling reach and may be exacerbated by the steepness of the right (west) bank. Heavy applications of sand during the winter should be discouraged along this portion of Clayton-Mill River Road, or BMPs should be implemented to trap "washout" and prevent sand migration into the stream. Biomonitoring is recommended at KR07 and KR08 during the next "year 2" phase in the basin cycle for this watershed. Slight impairment of the KR02 benthos appears the result of mild organic enrichment, as evidenced by instream deposits of fine organic material and the numerical dominance of Chironomidae. Adjacent agricultural activities are one obvious potential source of nutrient loadings and documented elevated levels of fecal coliform bacteria; however, other upstream sources of enrichment and/or nutrient loadings may exist as well. Restoration of the riparian zone along the KR02 reach may help to minimize NPS loadings to this portion of the river. Slight impairment of the KR01 macroinvertebrate community may be an early sign of NPS loadings—particularly sediment and nutrients—to this portion of the Konkapot River. An investigation into the need for BMP implementation to control road runoff at the Route 7A crossing is recommended. Biomonitoring is recommended at KR02 and KR01 during the next "year 2" phase in the basin cycle for this watershed. Attempts should be made to isolate sources of elevated fecal coliform bacteria documented by DWM at KR02 and KR01.

Williams River—Habitat and water quality here appear excellent, as reflected in the diverse assemblage of pollution-sensitive taxa at WR01. However, NPS pollution in the form of trash deposits were observed along both banks. Trash inputs to the river may be exacerbated by the steep, herbaceous nature of much of the stream bank. Dumping of trash from adjacent road crossings

should be strongly discouraged. Cleanup efforts should be conducted to eliminate existing trash deposits.

Furnace Brook—Slight impairment of the FB01 benthic community appears to be the result of naturally reduced base flows. An investigation into the presence/extent of damming structures in the impoundments of this watershed (especially the unnamed impoundment immediately upstream), is recommended. Additionally, water quantity information, including a flow duration curve, should be developed for this stream to better assess the relationship between biological integrity and streamflow. Observed disturbances to the riparian zone (clearing of vegetation, trash deposits) can be prevented by blocking off the dirt road that leads from Furnace Road to the stream.

Karner Brook—While water quality appears generally good in this stream, naturally low base flow may shape community structure at KR01. Increased withdrawals apparently come directly from this small stream via a pumphouse off Mount Washington Road, further exacerbating the naturally occurring low flow conditions present and impacting instream habitat and biological integrity at KB02. It is recommended that pumping activities be reduced during extreme low flow conditions. Additionally, water quantity information, including a flow duration curve, should be developed for this stream to better assess the relationship between biological integrity and streamflow.

Housatonic River (West Branch and Southwest Branch)—Slight/moderate levels of impairment at both the HW01 and HW02S biomonitoring stations result from a combination of habitat and water quality degradation. Attempts should be made to isolate sources (Barker Street may be one source of sand inputs) of inorganic and organic sediment loadings to HW02S, as severe instream deposition is a major limitation to biological integrity here. In addition, instream deposits of trash could easily be eliminated with an organized cleanup effort. As reflected in the habitat evaluation, habitat degradation—especially instream deposits of sediment and trash—is obviously limiting to resident biota at HW01 as well. Attempts should be made to eliminate dumping of trash along the right (west) bank of the HW01 sampling reach. Due to the urbanized nature of the West Branch sub-basin, it may be difficult to isolate sources of water quality impairment that compromise biological integrity at HW01. Stormwater and other water quality stressors associated with urban runoff appear to contribute to the enriched nature of this system, as reflected in the abundance of FPOM, algae, and pollution-tolerant forms of macroinvertebrates. In addition, the increasingly eutrophic nature of upstream impoundments may be reflected in downstream lentic communities as well. Additional water quality sampling (nutrients, fecal coliform bacteria, dissolved oxygen) is recommended during the next "year 2" phase of this basin's five-year cycle.

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APPENDIX A

TAXA LISTS FOR MACROINVERTEBRATE SAMPLES COLLECTED DURING THE 1997 HOUSATONIC RIVER WATERSHED SURVEY

Table C-A1. Species-level taxa list and counts, functional feeding group (FG), and tolerance values (TV) for macroinvertebrates collected from 10 stream sites in the Konkapot River between 25 and 28 August 1997.

TAXON	FG[1]	TV[2]	KR01	KR02	KR03	KR05	KR06	KR07	KR08	KR09	KR11	KR12
Ferrissia sp.	SC	7			1							
Enchytraeidae	GC	10			1							
Nais bretscheri	GC	6		2	1					1		
Nais variabilis	GC	10								2		
Gammarus sp.	GC	6	1									
Hydracarina	PR	6	6	6	6	1	4	2	3	2		1
Baetidae	GC	4	1		5	2	11	7	9	13	8	2
Baetis sp.	GC	6	5					1		4		
Baetis sp. 3 (3 caudal filaments)	GC	6					4					7
Isonychia sp.	GC	4		1	7	4	1		2	3		
Heptageniidae	SC	4	1	2	4		3	1			14	4
Epeorus sp.	SC	1										
Stenonema sp.	SC	3		4	7	7	3	1		3	8	
Ephemerellidae	GC	1					1	1		1	1	
Attenella sp.	GC	1							6			
Ephemerella sp.	GC	1								1		
Serratella sp.	GC	2		1	1							
Pteronarcys sp.	SH	2										1
Acroneuria sp.	PR	0					1					
Sweltsa sp.	PR	0									1	
Nigronia sp.	PR	6		1								
Tricoptera	GC	5			1							
Philopotamidae	FC	3					1				1	
Chimarra sp.	FC	3	2						3		13	27
Dolophilodes sp.	FC	1						1	4		1	
Wormaldia sp.	FC	0										2
Psychomyia sp.	GC	2	3	12		1						
Neureclipsis sp.	FC	4						1				
Nyctiophylax sp.	PR	1		1								
Hydropsychidae	FC	4			1		1		1	5		
Cheumatopsyche sp.	FC	7	8							1		4
Hydropsyche sp.	FC	4		5								
Hydropsyche betteni gr.	FC	8										9
Hydropsyche morosa gr.	FC	6	19		19	20	8	19	12	4	6	
Rhyacophila sp.	PR	1					1		1		1	
Rhyacophila fuscula	PR	2	1								1	

TAXON	FG[1]	TV[2]	KR01	KR02	KR03	KR05	KR06	KR07	KR08	KR09	KR11	KR12
Glossosoma sp.	SC	2		1	1	2		8				
Protoptila sp.	SC	3				2	1		1	9		
Leucotrichia sp.	SC	6	3		1	8	1	8				
Limnephilidae	SH	4			1							1
Goera sp.	SC	0								1		
Neophylax sp.	SC	2		1								
Helicopsyche borealis	SC	0				5	1			1		
Leptoceridae	PR	4					1					
Oecetis sp.	PR	6					1					
Setodes sp.	GC	1					1					
Ectopria sp.	SC	5						1			1	
Psephenus herricki	SC	3	1		3	1	2	1	1	3	2	1
Optioservus sp.	SC	3	9	7	12	12	9	9	25	8	2	
Optioservus ampliatus	SC	3				1						
Optioservus ovalis	SC	3	1					1				
Optioservus trivittatus	SC	3	4	1	6	1		1	4	1		
Oulimnius latiusculus	SC	2			2	1		1	2		1	
Promoresia sp.	SC	2	8		2	1		2			1	
Promoresia elegans	SC	2					1					
Stenelmis sp.	SC	5	2	1	2	1				2	3	5
Stenelmis crenata gr.	SC	5	1		1				1			
Tipulidae	SH	5		2			1					
Antocha sp.	GC	5	9	9	6	2	4	3	1	1		
Dicranota sp.	PR	0					1		1	1		
Hexatoma sp.	PR	5								1		
Probezzia sp.	PR	6								2		
Simuliidae	FC	6										1
Cnephia sp.	FC	4	1									
Simulium sp.	FC	4				3	1				2	2
Tanypodinae	PR	7		1								
Coelotanypus sp.	PR	7				1						
Conchapelopia sp.	PR	9				1					1	
Thienemannimyia gr.	PR	6		1						1		
Pagastia sp.	GC	2					2	2				
Potthastia gaedii gr.	GC	2		2	1					2		
Orthocladiinae	GC	5		1						1		
Cardiocladius sp.	PR	6			2							
Corynoneura sp.	GC	6					1					
Cricotopus sp.	SH	7		1								
Cricotopus/Orthocladius sp.	GC	7	1	2	1				1	1		
Cricotopus bicinctus	GC	7		1								
Cricotopus trifascia gr.	SH	6	1									
Eukiefferiella sp.	GC	6						3			1	

TAXON	FG[1]	TV[2]	KR01	KR02	KR03	KR05	KR06	KR07	KR08	KR09	KR11	KR12
Eukiefferiella brevicalcar gr.	GC	4						1				
Eukiefferiella devonica gr.	GC	4						1				
Krenosmittia sp.	GC	5									1	
Lopescladius sp.	GC	2									2	1
Nanocladius sp.	GC	7							1			
Orthocladius sp.	GC	6							1			
Parachaetocladius sp.	GC	0									2	
Parametriocnemus sp.	GC	4				2	1			3	1	4
Rheocricotopus sp.	GC	6				1				1		
Thienemanniella sp.	GC	6		4		1	1					
Tvetenia bavarica gr.	GC	5			1						1	
Tvetenia vitracies gr.	GC	5	6	1	1	2	1		3	2		
Chironomini	GC	6										1
Cryptochironomus sp.	PR	8		1								
Demicryptochironomus sp.	GC	2								1		
Microtendipes sp.	FC	6	3	5			1	1	3	4	1	
Polypedilum aviceps	SH	4						1	1			
Polypedilum convictum	SH	5			1	1			4			6
Polypedilum fallax gr.	SH	6	1									
Polypedilum illinoense	SH	9	1									
Polypedilum tritum	SH	6									1	
Tanytarsini	FC	6		1								
Cladotanytarsus sp.	FC	4		1	1		1			6		
Micropsectra sp.	GC	1		1		1	1		1		1	
Micropsectra/Tanytarsus sp	GC	4				1	1					
Rheotanytarsus sp.	FC	6				1			4		1	4
Rheotanytarsus distinctissimus gr.	FC	6		1	2	6	6	13			2	
Rheotanytarsus exiguus gr.	FC	6	4	4	2	14	4	3	5	4	8	8
Stempellinella sp.	GC	2									4	2
Sublettea coffmani	FC	2	1	6		1	4	2	1			
Tanytarsus sp.	FC	7		4			3			2		
Atherix sp.	PR	4			1				1		1	
Empididae	PR	6				1		1				
Chelifera sp.	PR	6		1			1					
Hemerodromia sp.	PR	6	2	3	1	1	1		1	4	1	3
TOTAL			107	99	105	110	94	97	106	102	96	96

[1] Functional feeding group (FG) lists the primary feeding habit of each species and follows the abbreviations: SH-Shredder; GC-Gathering Collector; FC-Filtering Collector; SC-Scraper; PR-Predator.

[2] Tolerance Value (TV) is an assigned value used in the calculation of the biotic index. Tolerance values range from 0 for organisms very intolerant of organic pollution to 10 for organisms very tolerant.

Table C-A2. Species-level taxa list and counts, functional feeding groups (FG), and tolerance values (TV) for macroinvertebrates collected from 10 stream sites in the Housatonic River watershed between 25 and 27 August 1997. Sampling stations were in the Housatonic River* (HR03, HR04, HR05, HR06), Southwest Branch Housatonic River (HW02S), West Branch Housatonic River (HW01), Furnace Brook (FB01), Williams River (WR01), and Karner Brook (KB01, KB02).

TAXON	FG[1]	TV[2]	HR03	HR04	HR05	HR06	HW02S	HW01	FB01	WR01	KB01	KB02
Ferrissia sp.	SC	7		2		1	1	2				
Pisidiidae	FC	6			2		1	1		1		
Lumbricina	GC	8								2		
Enchytraeidae	GC	10							2			
Nais bretscheri	GC	6					2	4				
Nais communis	GC	8					1	2	3			
Nais pseudobtusa	GC	9							1			
Hyalella azteca	GC	8		1								
Hydracarina	PR	6	1	1	1	1	3	2				2
Baetidae	GC	4	7	8	3	2			4	10	3	2
Baetis sp.	GC	6			7							
Baetis sp. 1 (2 cerci)	GC	6				5				1		
Baetis sp. 2(short terminal filament)	GC	6				1						
Baetis sp. 3 (3 caudal filaments)	GC	6				7			1	1		
Isonychia sp.	GC	4				1	3		5	1	1	
Heptageniidae	SC	4	3	1	3	1		2	1		2	2
Epeorus sp.	SC	1									5	5
Stenacron sp.	SC	7		1								
Stenonema sp.	SC	3		1	3		3	4	1	2		
Ephemerellidae	GC	1							5			1
Attenella sp.	GC	1			6						2	
Ephemerella sp.	GC	1	1									
Caenis sp.	GC	8	4	4	2	4						
Stylogomphus albistylus	PR	5								1		
Pteronarcys sp.	SH	2										1
Tallaperla sp.	SH	0										1
Leuctridae	SH	0							1		2	
Perlidae	PR	1								1		
Acroneuria sp.	PR	0								1		
Agnetina sp.	PR	2							1			
Paragnetina sp.	PR	1	1									
Perlodidae	PR	2							1			
Diura sp.	PR	2									1	
Chloroperlidae	PR	1										1
Sweltsa sp.	PR	0									7	4
Corydalus sp.	PR	6								2		
Nigronia sp.	PR	6							1			
Chimarra sp.	FC	3			4	1				7		

TAXON	FG[1]	TV[2]	HR03	HR04	HR05	HR06	HW02S	HW01	FB01	WR01	KB01	KB02
Dolophilodes sp.	FC	1				1			4		2	1
Psychomyiidae	GC	2									1	
Psychomyia sp.	GC	2			1							
Polycentropodidae	FC	6								2		
Hydropsychidae	FC	4	6	2			3	7	2	2		
Cheumatopsyche sp.	FC	7		2	1	4	2	23		1		
Hydropsyche sp.	FC	4					1					
Hydropsyche betteni gr.	FC	8						2			5	
Hydropsyche morosa gr.	FC	6	14	1	9	3		1		4		
Macrostemum zebratum	FC	3			9					1		
Rhyacophila sp.	PR	1							1	1	1	
Protoptila sp.	SC	3	1		2							
Hydroptila sp.	GC	6				2		1				
Leucotrichia sp.	SC	6	1		2							
Lepidostomatidae	SH	1										5
Lepidostoma sp.	SH	1							4		5	
Helicopsyche borealis	SC	0							3	8		
Helophorus sp.	SH	8									1	
Psephenus herricki	SC	3				1	3	1		1		
Optioservus sp.	SC	3	3		4	1	64	8	7	9		3
Optioservus trivittatus	SC	3					3					
Oulimnius latiusculus	SC	2					1			3	3	1
Promoresia sp.	SC	2								13		
Promoresia elegans	SC	2								2		
Promoresia tardella	SC	0								1		
Stenelmis sp.	SC	5	8	2	19	16		23		11		
Stenelmis crenata gr.	SC	5	1									
Antocha sp.	GC	5	6		4			2		3		
Hexatoma sp.	PR	5							1		1	
Probezzia sp.	PR	6							6			
Simulium sp.	FC	4		2	4	11	2		1			
Tanypodinae	PR	7		1		1				1		
Conchapelopia sp.	PR	9	2	3					1	1		
Krenopelopia sp.	PR	7							1			
Larsia sp.	PR	8										
Rheopelopia sp.	PR	4	1	2	1					1		
Thienemannimyia sp.	PR	6			1				1			
Diamesa sp.	GC	8	2					4				
Pagastia sp.	GC	2							1			
Potthastia gaedii gr.	GC	2					1					
Cardiocladius sp.	PR	6	3	1	1							
Cricotopus sp.	SH	7	2	1								
Cricotopus/Orthocladius sp.	GC	7					1	6				

TAXON	FG[1]	TV[2]	HR03	HR04	HR05	HR06	HW02S	HW01	FB01	WR01	KB01	KB02
Cricotopus bicinctus	GC	7	1	37		2						
Cricotopus trifascia gr.	SH	6	2	8								
Cricotopus vierriensis	SH	7					1					
Nanocladius sp.	GC	7								1		
Orthocladius sp.	GC	6				1						
Orthocladius annectans	GC	6		1								
Parametriocnemus sp.	GC	4							2			
Psilometriocnemus sp.	GC	5										1
Synorthocladius sp.	GC	5	6	1								
Thienemanniella sp.	GC	6				1				1		
Tokunagaia sp.	GC	5							1			
Tvetenia sp.	GC	5		1					1			
Tvetenia vitracies gr.	GC	5	3	4								
Dicrotendipes sp.	GC	8	1	1								
Microtendipes sp.	FC	6	4									
Polypedilum sp.	SH	6		2								
Polypedilum angulum	SH	6							3			
Polypedilum aviceps	SH	4							2			1
Polypedilum convictum	SH	5	8	1	2	7						
Polypedilum fallax gr.	SH	6							1			
Polypedilum obtusum	SH	6				2						
Tribelos sp.	GC	7		1								
Cladotanytarsus sp.	FC	4			2	6						
Micropsectra sp.	GC	1							21		48	74
Micropsectra/Tanytarsus sp.	GC	4						1	9		5	
Paratanytarsus sp.	FC	8							1			
Rheotanytarsus sp.	FC	6	1				1					
Rheotanytarsus distinctissimus gr.	FC	6	1	1		1	1		1	2		
Rheotanytarsus exiguus gr.	FC	6	4	4						3		
Stempellina sp.	GC	2							2			
Stempellinella sp.	GC	2										1
Tanytarsus sp.	FC	7	1	8	1	3	1	1	3			2
Atherix sp.	PR	4			1	3	1			1	1	3
Chelifera sp.	PR	6				1	1	2			1	
Hemerodromia sp.	PR	6	2		2	1	2	2		2		
TOTAL			101	106	97	92	103	101	107	105	97	111

* data analyses for these benthos assemblages conducted and discussed by Szal (1999) in a separate technical memorandum

[1] Functional feeding group (FG) lists the primary feeding habit of each species and follows the abbreviations: SH-Shredder; GC-Gathering Collector; FC-Filtering Collector; SC-Scraper; PR-Predator.

[2] Tolerance Value (TV) is an assigned value used in the calculation of the biotic index. Tolerance values range from 0 for organisms very intolerant of organic pollution to 10 for organisms very tolerant.

APPENDIX B

Data Analyses for Macroinvertebrate Samples Collected During the 1997 Housatonic River Watershed Survey

Table C-B1. Summary of RBP III data analysis for macroinvertebrate communities sampled at stations in the Housatonic River watershed between 25 and 28 August 1997. Seven biological metrics were calculated and scored (in italics) for taxa collected at each station. Scores were then totaled and compared to the regional reference station (KR11). The percent comparability to the reference station yields a final impairment score for each study site.

STATION #	KR11		KR01		KR02		KR03		KR08		KR06		KR01		KR08		KR09		KR12	
Stream	Konkapot River		Konkapot River		Konkapot River		Konkapot River		Konkapot River		Konkapot River		Konkapot River		Konkapot River		Konkapot River		Konkapot River	
Habitat Score	180		178		123		177		172		178		171		154		119		138	
Taxa Richness	30	*6*	29	*6*	29	*6*	29	*6*	30	*6*	35	*6*	25	*6*	29	*6*	31	*6*	18	*4*
Biotic Index	3.84	*6*	4.92	*4*	4.39	*6*	4.92	*4*	4.57	*4*	4.27	*6*	4.59	*4*	3.96	*6*	4.36	*6*	4.68	*4*
Ept Index	8	*6*	8	*6*	8	*6*	8	*6*	9	*6*	10	*6*	8	*6*	8	*6*	9	*6*	8	*6*
Ept/Chironomidae	2.04	*6*	2.26	*6*	0.74	*2*	4.00	*6*	1.55	*6*	1.55	*6*	1.78	*6*	1.44	*4*	1.64	*6*	2.19	*6*
Scrapers/Filterers	0.91	*6*	0.70	*6*	0.63	*6*	1.64	*6*	0.93	*6*	0.70	*6*	0.85	*6*	1.03	*6*	4.00	*6*	0.70	*6*
% Dominant Taxon	15%	*6*	18%	*6*	12%	*6*	18%	*6*	18%	*6*	12%	*6*	20%	*4*	20%	*4*	13%	*6*	28%	*4*
Community Similarity	100%	*6*	20%	*6*	17%	*6*	38%	*2*	37%	*2*	33%	*2*	30%	*2*	33%	*2*	29%	*6*	10%	*2*
Total Metric Score		*42*		*38*		*32*		*36*		*38*		*38*		*38*		*34*		*36*		*26*
% Comparability To Reference Station			81%		76%		86%		86%		90%		81%		81%		86%		62%	
Biological Condition - Degree Impairment	**REFERENCE**		**SLIGHT/ NON**		**SLIGHT**		NON		**NON**		**NON**		**SLIGHT/ NON**		**SLIGHT/ NON**		NON		**SLIGHT**	

Table C-B2. Summary of RBP III data analysis for macroinvertebrate communities sampled at stations in the Housatonic River watershed between 25 and 27 August 1997. Seven biological metrics were calculated and scored (in italics) for taxa collected at each station. Scores were then totaled and compared to the regional reference station (KR11). The percent comparability to the reference station yields a final impairment score for each study site.

STATION #	KR11		HW02S		HW01		FB01		WR01	
STREAM	Konkapot River		SW Branch Housatonic River		West Branch Housatonic River		Furnace Brook		Williams River	
HABITAT SCORE	180		137		107		150		169	
TAXA RICHNESS	30	*6*	20	*0*	19	*0*	35	*6*	31	*6*
BIOTIC INDEX	3.84	*6*	3.68	*6*	5.64	*2*	3.46	*6*	3.74	*6*
EPT INDEX	8	*6*	4	*0*	5	*0*	12	*6*	12	*6*
EPT/CHIRONOMIDAE	2.04	*6*	2.00	*6*	3.33	*0*	0.67	*2*	4.30	*6*
SCRAPERS/FILTERERS	0.91	*6*	6.25	*6*	1.14	*0*	1.00	*6*	2.17	*6*
% DOMINANT TAXON	15%	*6*	62%	*0*	23%	*0*	23%	*4*	12%	*6*
COMMUNITY SIMILARITY	100%	*6*	14%	*0*	14%	*0*	18%	*6*	38%	*2*
TOTAL METRIC SCORE		*42*		*22*		*22*		*30*		*38*
% COMPARABILITY TO REFERENCE STATION			52%		52%		71%		90%	
BIOLOGICAL CONDITION - DEGREE IMPAIRMENT	REFERENCE		SLIGHT/ MODERATE		SLIGHT/ MODERATE		SLIGHT		NON	

Table C-B3. Summary of RBP III data analysis for macroinvertebrate communities sampled in Karner Brook (a tributary stream in the Housatonic River watershed) during 26 August 1997. Seven biological metrics were calculated and scored (in italics) for taxa collected at each station. Scores were then totaled and compared to the upstream reference station (KB01). The percent comparability of KR02 to the reference station yields a final impairment score. The sampling stations bracketed the pumping station.

	Pumping Station is between sampling stations.			
STATION #	KB01		KB02	
STREAM	Karner Brook (upstream)		Karner Brook (downstream)	
HABITAT SCORE	164		146	
TAXA RICHNESS	18	*6*	17	*6*
BIOTIC INDEX	1.86	*6*	1.49	*6*
EPT INDEX	12	*6*	8	*0*
EPT/CHIRONOMIDAE	0.70	*6*	0.29	*2*
SCRAPERS/FILTERERS	1.43	*6*	3.67	*6*
% DOMINANT TAXON	49%	*0*	67%	*0*
COMMUNITY SIMILARITY	100%	*6*	65%	*4*
TOTAL METRIC SCORE	*36*		*24*	
% COMPARABILITY TO REFERENCE STATION			67%	
BIOLOGICAL CONDITION-DEGREE IMPAIRMENT	REFERENCE		SLIGHT	

Table C-B4. Habitat assessment summary for macroinvertebrate biomonitoring stations sampled during the 1997 Housatonic River watershed survey. For those primary parameters, scores ranging from 16-20 = optimal; 11-15 = suboptimal; 6-10 = marginal; 0-5 = poor. For those secondary parameters, scores ranging from 9-10 = optimal; 6-8 = suboptimal; 3-5 = marginal; 0-2 = poor.

Station	KR01	KR02	KR03	KR05	KR06	KR07	KR08	KR09	KR11	KR12	HW02S	HW01	WR01	FB01	KB01	KB02
Primary Parameters (range is 0-20)																
Instream Cover	20	7	19	19	19	19	15	11	20	11	12	8	20	10	14	13
Epifaunal Substrate	16	16	20	20	17	20	20	11	18	19	12	11	20	20	20	20
Embeddedness	17	6	15	15	13	16	9	6	16	14	8	6	9	10	20	19
Channel Alteration	14	8	18	11	20	15	18	20	16	19	12	11	15	20	20	12
Sediment Deposition	13	2	17	15	17	14	18	7	18	9	5	6	17	17	20	20
Velocity-Depth Combinations	18	16	20	20	20	18	13	12	19	12	15	6	20	10	11	10
Channel Flow Status	18	20	19	19	18	18	10	16	15	8	16	19	19	8	7	6
Secondary Parameters (range is 0-10 for each bank)																
Bank Vegetative Protection	18	20	19	20	20	20	19	20	20	20	19	18	19	20	20	18
Bank Stability	18	20	17	20	18	18	18	4	18	12	20	14	16	18	17	17
Riparian Vegetative Zone Width	20	8	13	13	16	13	14	12	20	14	18	8	14	17	15	11
Total Score	172	123	177	172	178	171	154	119	180	138	137	107	169	150	164	146

APPENDIX D - DEP MACROINVERTEBRATE TECHNICAL MEMORANDUM

Re: **1997 Housatonic Survey: Macroinvertebrate RBP II Evaluations Upstream and Downstream of NPDES Discharges**

DATE: APRIL 14, 1999

Author: Gerald M. Szal, Environmental Analyst, Division of Watershed Management, Worcester

OVERVIEW

Over the late summer months of 1997 I coordinated upstream/downstream macroinvertebrate impact evaluations of four NPDES discharges in the Housatonic River basin. I was assisted by personnel from this office and from the Western Regional DEP office in Springfield. Potential impacts of the four discharges were assessed using U.S. Environmental Protection Agency (EPA) Rapid Bioassessment Protocols (Plafkin, *et al.*, 1989) for family-level assessments of macroinvertebrates with some minor changes as outlined below (in Sampling Methods and Analytical Methods). The facilities investigated were Crane and Company in Dalton, the Pittsfield POTW in Pittsfield, Schweitzer Mauduit (formerly Kimberly-Clark) in Lee, and the Great Barrington POTW in Great Barrington.

Investigators using the RBP methods usually select stations upstream and downstream of the discharge. These stations are referred to here as the reference and test stations, respectively. Stations are chosen which are as similar as possible to each other in habitat characteristics known to affect macroinvertebrate community structure and function. When a suitable upstream reference station is lacking, a reference station may be located on another stream. In either case, an array of habitat characteristics at the two stations is evaluated and scored. If the difference in scores between the stations is within the margin specified by EPA, the two sites are considered to be similar enough to allow a direct comparison of the invertebrate taxa sampled. If the habitat scores are too widely separated, EPA has outlined methods of conducting an adjusted comparison, which takes these differences into account. Habitat variables listed in the original EPA RBP manual have been updated for DWM and can be obtained upon request.

Macroinvertebrates are collected from reference and test stations, preserved in alcohol and brought back to the laboratory. A randomization procedure is used to separate a 100-organism subsample from the larger field sample. If the investigator uses the RBPII methods, as I did in these evaluations, organisms in the subsamples are identified to family level and compiled into taxa lists by station. A number of metrics are calculated from the taxa lists and metric scores from the two stations are compared to EPA scoring criteria. Reference/test station metric comparisons yield an assessment of presence/absence and degree of negative change between the communities sampled. This change is interpreted as the "impact" of the pollutant source evaluated.

SAMPLING TECHNIQUES

Two different macroinvertebrate collection techniques were used in these studies: kick-net sampling and the deployment of Hester-Dendy samplers. The first of these is the more temporally efficient as the investigator only needs to visit the site once to collect a sample. Kick-net samples were collected for the evaluations in Great Barrington and Lee where riffles were found that were fairly similar in most habitat characteristics both upstream and downstream of these facilities. At these sites I collected 10 kick-net samples at different spots using nets that had a mesh size of 0.5 mm and a width of 0.46 meters. A sample of approximately 2 square meters of bottom results from this process.

Invertebrates taken from Hester-Dendy samplers (see Klemm, *et al.* 1990 for a description) were used to evaluate the discharges from the Pittsfield POTW and the Crane Paper Company. These samplers are composed of a series of particleboard plates separated by spacers. The samplers were attached to concrete blocks and placed in the stream bottom at the study sites for six weeks, over which time they were colonized by benthic invertebrates. At the end of the period allotted for colonization, DWM personnel cut the attachments, transferred the samplers to nets and fixed the samplers and accompanying invertebrates in alcohol for transfer to the laboratory. Hester-Dendy samplers were used at these sites because the river upstream and downstream of the discharges was slow moving and did not appear, to

this investigator, to provide habitats that would have produced a diverse assemblage of macroinvertebrates. The samplers provide colonization sites and typically produce a greater diversity of invertebrates than sandy substrates such as those found at the sites mentioned above. Hester-Dendy, and other artificial substrates, also increase the reproducibility of survey results within a stream reach as they provide a suite of habitats that has negligible structural variability between samplers.

Station locations for invertebrate collection sites are listed in Table D1. Copies of the Field Data sheets for six of the stations are available upon request. Those for the Pittsfield stations are missing (see discussion under Site Descriptions). Distance to station locations from landmarks was estimated in the field and may differ from that given in Table D1. Distances given in the latter were derived from GIS maps.

Table D1. 1997 Housatonic station locations for macroinvertebrate surveys upstream and downstream of NPDES discharges.

Sampling Date	Station Number	Description	Sampling Technique
26 August – 8 October 1977	21-EBH01	in the East Branch of the Housatonic River, ~ 30 meters upstream of the discharge from the Crane & Company WWTP, Pittsfield	Hester-Dendy
26 August – 8 October 1977	21-EBH02	in the East Branch of the Housatonic River, ~ 100 meters downstream from the Crane & Company WWTP discharge, Pittsfield	Hester-Dendy
26 August – 8 October 1977	21-HR01	in the mainstem Housatonic River, ~ 100 meters upstream of the confluence of the Housatonic River and the discharge canal from the Pittsfield POTW, Pittsfield	Hester-Dendy
26 August – 8 October 1977	21-HR02	in the mainstem Housatonic River, about 25 meters downstream of the confluence of the Pittsfield POTW discharge and the Housatonic River at the Pittsfield/Lenox line	Hester-Dendy
26 August 1997	21-HR03	in the mainstem Housatonic River, about 125 meters upstream of the Golden Hill Road bridge which is upstream of the Schweitzer Mauduit WWTP discharge to the Housatonic River in the town of Lee	Kick
25 August 1997	21-HR04	in the mainstem Housatonic River, approx. 470 meters downstream of the Schweitzer Mauduit Company discharge to the Housatonic in the town of Lee	Kick
25 August 1997	21-HR05	in the mainstem Housatonic River, about 625 meters upstream of the Great Barrington POTW discharge to the Housatonic River in the town of Great Barrington	Kick
25 August 1997	21-HR06	in the mainstem Housatonic River, about 400 meters downstream of the Great Barrington POTW discharge to the Housatonic in the town of Great Barrington	Kick

ANALYTICAL METHODS

EPA RBP analysis calls for multi-metric comparisons between invertebrate samples collected at reference and test stations. The RBP metrics are used to evaluate differences in the communities sampled with regard to structure, feeding function and tolerance to certain types of pollution. Six of the eight RBP metrics recommended by EPA are used by DWM along with one additional metric, the Percent Community Similarity index. This metric is used in lieu of the Community Loss metric described in the RBP manual. In addition, DWM does not use the Ratio of Shredders/Total metric from the original EPA RBP. A description of each of the EPA RBP metrics and their expected rise or fall concomitant with deteriorating water quality is provided in Plafkin, *et al.* A description of the Community Similarity index is provided below.

The Community Similarity index is used to compare the relative distribution of individuals across taxonomic groupings in the reference and test station samples. First, the number of individuals found in each taxa group common to both stations is converted to a proportion of the total number of individuals in the sample collected at each station. Second, for each taxon common to both stations one chooses the smaller of the two proportions. Third, one sums these values for all common taxa groups and multiplies the total by 100. The result is the percent similarity between the two stations. This can vary from 0 (no taxa common to both groups) to 100 (both stations having the same relative proportion of individuals in each taxon). For this metric, a value of 70% or greater received a Criterion Score of 6; metric values that were $\geq$ 25% but <70

received a 3; metric values of less than 25% received a zero. Scoring criteria for this metric were developed by DWM personnel.

The remaining six metrics are evaluated by computing ratios of reference and test stations metric values. Metric ratios for these six metrics are given a score of 0, 3 or 6 based on a criteria table prepared by EPA in the RBP document. Scores for all test station metrics are summed and compared to the sum of the scores from the reference station. The ratio of test station to reference station scores is called the Percent Comparability of the test station to the reference station.

A high Percent Comparability value for a test station is assumed to indicate that the benthic community sampled is similar to that at the reference station or that any dissimilarities seen are not detrimental. In this case a judgement of "No Impact" is awarded to the test station. We assume that a low Percent Comparability score indicates that there are differences in the structure and/or function of the community sampled at the two stations and that these differences are of a detrimental nature. Depending on both the degree and type of differences between reference and test stations, the level of impact ascribed to test stations will vary.

The RBP process also includes a comparison of habitat scores at reference and test stations. In general, we assume that minor differences ($\leq$ 10%) in habitat scores do not affect the interpretation of the degree of impact at test stations. However, as major habitat differences are expected to alter the composition of invertebrate communities, large differences in habitat scores may alter the assessment of impact. The degree of allowable difference between reference and test stations and its effect on interpreting degree of impact between these stations is a sliding scale that is described in the EPA RBP document.

At the sites where Hester-Dendy samplers were used, three individual 100-organism samples were collected. This allowed a statistical comparison to be made between metric values from the taxa lists compiled at reference and test stations. In order to use analysis of variance techniques to compare means, the investigator should determine that the values approximate those from a normal distribution, that the variance in one sample collection is not significantly different from that in another and that the samples were collected at random. In some of the cases, the assumption that variances were the same did not hold true, so I chose to use a non-parametric test, the Mann-Whitney U test. An alpha level of 0.05 was chosen in a one-tailed test of the hypothesis that there was no difference between mean metric scores at reference and test stations. The one-tailed test, rather than the two-tailed test, was used because I was interested in evaluating whether or not one group of metric values was significantly greater than the other.

Each of the values for test/reference station metrics used in RBP analyses should be interpreted cautiously. Take, for example, the EPT metric, which is simply the number of taxa in the Ephemeroptera, Plecoptera and Trichoptera orders. These orders have been singled out because they typically contain taxa which have demonstrated intolerance to organic wastes and low dissolved oxygen concentrations. RBP methods dictate that if the ratio of test/reference station EPT values is greater than 90%, one is to assume that the EPT communities at the two stations are not different. However, often one encounters (rare) taxa that are represented by only one individual. We might expect that if we were to sample reference stations a second time, the probability of finding the exact same number of EPT taxa in the two samples would decrease as the proportion of rare EPT taxa increases. How then are we to evaluate reference/test station EPT values from stations with a high proportion of rare taxa? This becomes especially problematic when the number of EPT taxa in the reference station sample drops below a value of 10. In this case, a change in EPT of one or more can become a penalty for the test station. For this reason, it is prudent to take a careful look at the EPT metric comparisons to determine whether differences in EPT might be within that routinely expected as the RBP does not provide a method of taking this fairly common event into consideration.

The metrics that are ratios, the EPT/Chironomids and the Scrapers/Filterer-Collectors metrics, have their own peculiar problems. When either the numerator or denominator in either of these ratios is a very small number, a change in one or two individuals can greatly influence the ratio value. One can easily see that if a number of samples were taken from a particular site, and the numerator or denominator in these ratios was small, the variance for this ratio among different samples could be quite large. Changes from sample to sample of one or two individuals should be expected, but this has not been taken into account in the EPA RBP.

The two metrics discussed in the paragraph above are used to compare structural and functional components of the sampled communities. Another method of doing this is to simply take each numerator and denominator of the metrics and compare metric values for reference and test stations. I believe that additional analysis such as this can greatly assist researchers in better understanding the nature of any community alterations that have taken place and in interpreting the robustness of impact determinations.

SITE DESCRIPTIONS

Crane Paper: This facility manufactures specialty papers and is famous for its long-time production of U.S. currency paper. Although the NPDES permit does not have a limit on flow, the treatment operator told me that daily flows are in the 3-5.5 MGD range and the mills produce wastewater 24 hrs/day, 7 days per week. Both times I visited the facility, there was a rust-colored floc coating the sides and bottom of the discharge canal.

Hester-Dendy samplers at the test station were placed about 100 meters downstream of the discharge canal in fairly slow-moving waters which were between 0.5 and 0.7 meters in depth. Stream substrates at the test station were composed of about 60% cobble, 20% gravel, and 20% sand. A heavy layer of silt and rust-colored floc covered all stream substrates at the test station. Brown periphyton was evident at this station in some spots and the water was very turbid throughout the sampling area. Turbidity was a result of both the discharge, which was visible as a plume, as well as the fact that the stream banks in this area were eroding. Oak, poplar and willow dominated the tree species on the north and south banks. The south bank had an open field adjacent to a strip of trees that ran along the bank. The total habitat score at this station was 108.

Samplers at the reference station were positioned about 30 meters upstream of the discharge in substrates that were nearly identical to the test station (cobble: 60%, gravel: 20%, sand: 20%). Water velocity at this station, though not measured, was slow moving and appeared to be similar to that at the test station. Samplers were placed in areas where the depth was between 0.5 and 0.7 meters. A very fine layer of silt covered the substrates and was probably due to erosion from the stream banks which were similar to those at the downstream station. Riparian vegetation was more varied at the reference station with good representation of trees (oaks, poplars, birches, willow), shrubs, grasses and herbaceous plants. The water at this station was fairly clear. Upstream of the discharge there is a 200-meter or so slow-moving section of water. Directly upstream of these quiet waters there is a series of riffles. The habitat score for this station was 125. Differences in reference and test station habitat scores exceeded 10%. However, intersite differences were directly attributable to sediment deposition which appeared to be due to the discharge. Because this change in habitat was a result of the discharge, reference and test station data were directly compared.

We placed our samplers in the receiving stream on August 26, 1997 and retrieved them on the 8th of October, 1997, a six-week deployment. Three samplers were used at each station. All were retrieved and none appeared to have been disturbed.

Pittsfield POTW: This facility is located at the southernmost end of the city of Pittsfield near the Lenox town line, a couple of miles downstream of the "downtown" section of Pittsfield. This is a fairly large facility, with a monthly average permitted flow of 17 MGD (maximum daily flow of 28.7 MGD). We visited this facility three times; on all three occasions the effluent was clear.

Habitat sheets are not available for the reference or test stations at this site but habitats were very similar at the two stations bracketing this discharge. The river is fairly deep (over 1.5 meters) in certain areas upstream of the discharge channel. River width was about 10-15 meters from our point of boat entry, about ½ mile upstream of the discharge, to our test station. Greatly slumped banks are common in this area as are completely denuded, severely eroded areas. Benthic sediments at the two collection stations were primarily sand. An abundance of fallen trees criss-crossed the river from our point of boat entry to the study sites, and probably provided a good deal of the variety in benthic habitats available to macroinvertebrates inhabiting the river in the vicinity of the discharge. Water clarity in this area was not good. A large field planted in corn abutted the southern stream bank and in areas there was no natural

vegetative strip along this stream bank. Much of the northern bank of the stream was vegetated with trees.

Hester-Dendy samplers were positioned differently at the reference and test stations. They were placed atop cement blocks at the reference station, about 100 meters upstream of the discharge canal, where the water depth was about 0.5 meters. The test station was located approximately 25 meters downstream of the discharge channel. Immediately downstream of this station an enormous log jam (>30 meters in length) completely blocked the channel and prohibited our safe travel farther downstream. The test station samplers were placed in an area where the discharge was not completely mixed with the receiving stream. It appeared that the effluent plume was moving back and forth across the receiving stream due to the effects of another logjam farther upstream. As a result, our samplers, which were hung from a submerged log, were at times directly in the effluent plume and other times outside of the influence of the plume. River depth at the test station was about 1.5 meters. Our samplers hung about 0.5 meters below the surface.

Three samplers were deployed and retrieved at each station. None appeared to have been disturbed. They were in place for six weeks, from August 26th to October 8th, 1997.

Schweitzer Mauduit: This facility has a number of discharges which flow into the mainstem Housatonic. Two of these are located at a dam which lies approximately a mile upstream of the Rte. 20 river crossing in Lee. One of the two pipes at this dam discharges treatment plant wastewater. On all three occasions that we visited the plant, this discharge was completely opaque and looked like clay-colored milk. On these occasions, the river, below the discharge, did not meet Class B Water Quality Standards for swimming as one could only see about 8-12 inches into the water column. Upstream of the discharge I could easily see into pools that were at least 4 ft. in depth, our Class B standard for swimming. In addition, this discharge violated the aesthetics narrative in the standards.

The wastewater discharge permit for Schweitzer Mauduit does not have a flow limit. The fact sheet from the 1989 permit to Kimberly Clark which was transferred to Schweitzer Mauduit in February, 1996, lists the Average Monthly Discharge as 2.79 MGD and the Daily Maximum Flow as 4.46 MGD for the wastewater discharge 002/003. TSS for this permit is listed in lbs/day and so I could not ascertain whether or not the permit limit for this variable had been violated.

Habitat characteristics were fairly similar at the test and reference stations. I collected invertebrates at both stations using kick sampling.

The reference station was located in a wide riffle, about 0.6 miles upstream of the dam referenced above, and about 125 meters upstream of the Golden Hill Road bridge. Benthic substrates at this station were composed of cobble (~70%), gravel (~10%), and sand (~20%) with a small component of silt (~2%). Current velocity across the spots sampled at the reference station ranged from 0.90 to 1.76 ft/sec and averaged 1.26 ft/sec. Estimated stream width was 22-25 meters. Stream depth in the sampling area ranged from 0.15-0.36 meters. Riparian vegetation was composed of a mix of shrubs and hardwoods. Green and brown periphyton covered most of the stream substrates. The total habitat score at this station was 172.

The test station was located about 470 meters downstream of the discharge (and dam) where a large pipe, which I was told belongs the facility, crosses the streambed. Kick samples were collected downstream of this pipe in a riffle that extended across most of the stream channel. Water depth in the areas sampled was 0.15 – 0.5 meters. The river was about 14 meters wide at this station. Water velocity in the areas sampled ranged from 0.34 – 1.33 ft/sec and averaged about 1 ft/sec. There were some attached macrophytes at this station that we measured at over 8' in length. Brown periphyton was observed on many of the substrates and most sediment surfaces were covered with fine-grained brown sediment, although embeddedness of the cobbles I moved was extremely low (<25%). Riparian vegetation on the west side of the river was primarily hardwood and shrub with grasses and herbaceous plants along the bank. The east side of the river had a 6-12 meter riparian zone of shrubs and grasses; beyond this were the grounds of the facility which was paved. The habitat score for this station was 170, essentially the same as that for the reference station.

Great Barrington POTW: The September 1990 NPDES permit for this facility lists an average monthly flow of 3.2 MGD. It discharges to an unwadeable (due to depth) section of the Housatonic. On the first of three occasions that I visited this facility (with Steve Halterman, now of the Western Regional Office), the clarifiers and aeration tanks were a deep red color, as was the effluent. The operator told us that the facility received a substantial proportion of its waste from Rising Paper, a facility that was not pre-treating their waste. The operator also mentioned that, depending on the day, the plant would receive waste of other colors. The effluent plume was substantial and visible for about 3/8 of a mile downstream of the plant. I expect that during low river flows this distance would be much greater. This situation, as that at the Schweitzer Mauduit facility, is a violation of the Massachusetts Water Quality Standards for aesthetics.

The reference station for the Great Barrington evaluation was located about 625 meters upstream of the discharge from this facility, in the vicinity of St. Peter's church. The town has put in a short walking trail along the southwest side of the river in this area and the riverbank and riverbed have long stretches of rock outcroppings here. There were some stretches of rip-rap along the southwestern bank as well. The sampling area was at the beginning of a substantial change in streambed elevation which resulted in a long expanse of riffle. Hardwoods predominated the riparian vegetation on both sides of the river but did not extend very far up the riverbanks. Some brown periphyton covered most substrates. When we collected kick samples for this study, the river was quite deep. The only areas that were wadeable and that also had cobble/gravel substrates were those along the northeast side of the river. We sampled in these areas. River width in this location was about 15 meters. The habitat score at this station was 135.

Benthic substrates at the reference station were about equally distributed among cobble (40%), gravel (30%) and sand (30%). This is a highly erosional (as opposed to depositional) area and there was no visible silt or fine sediment in the areas sampled. Water velocity in the spots sampled averaged 1.3 ft/second and ranged from 0.5 to 2.1 ft/sec. I sampled only riffles which ranged in depth from 0.2 to 0.46 meters. Our sampling was conducted at the head of the riffle in an attempt to correlate our work with that at the test station where only a short riffle was available. Upstream conditions were different at the two stations: at the reference station cobble/boulder substrates predominated, while directly upstream of the test station, the predominant benthic sediment was sand. This difference between the two stations is not reflected in the habitat scores. The score for this station was 131.

The test station for the Great Barrington evaluation was located directly under electrical power lines (which do not show up on the 1987 USGS topographic maps), located approximately 400 meters downstream of the plant discharge to the Housatonic. I sampled two small riffle areas which were located on both sides of a small island in the river. River width directly upstream of this island was approximately 18 meters. Water velocity in the areas sampled ranged from 0.8 to 2.5 ft/sec and averaged about 1.6 ft/sec. Stream depth in the these areas was within the same range as that at the reference station (0.2-0.46 meters). Substrate composition in these riffles was cobble (35%), gravel (35%) and sand (30%), very similar to that at the reference station. Most surfaces were covered by brown algae. No fine-grained materials were observed in the areas sampled. Deciduous trees dominated the riparian zone with a fair proportion (20%) of shrubs. An extensive area of grasses and shrubs was present under the power lines, with grasses predominating on the east bank. Embeddedness of cobbles was substantial (about 35%) and was primarily due to sand. Both riverbanks upstream of the test station had vertical dirt banks that appeared to have a high potential for erosion.

RESULTS

Crane Paper: The final score for the RBP test station:reference station comparison (64% - see Table 3A) for this site fell in the "MODERATE IMPACTS" category. This determination is supported by analysis of metrics in addition to those used in the RBP.

The taxa lists (Table 2) from reference and test stations at this site are quite different. The reference station sample was dominated by midges (chironomids – about 71% of the samples, on average) while that from the test station was dominated by naidid worms (47% of the samples, on average). Differences between the two taxa lists are dramatic as no naidids were found in any of the reference station samples. Naidid worms are much more tolerant of low oxygen concentrations than are the taxa collected upstream

of the discharge. The large relative proportion of naidids at the test station negatively affected a number of metrics.

Biotic Index values for the test station samples are about 44% higher, on average (7.58/5.27) than those for the reference station sample, an effect of the substantial naidid presence mentioned. This is a large difference and was statistically significant as well. Within-station variability of Biotic Index values was low: all three of the test station sample Biotic Index values lay between 7 and 8 and all three of the Biotic Index values from the reference station lay between 5.18 and 5.4. Since the differences between test and reference station Biotic Index values are consistently large among all the sample replicates, I am fairly confident that they reflect a substantial change in the tolerance of these two communities to low oxygen.

EPT in the test station samples was not significantly lower than that from the reference station samples. In my opinion, however, the use of presence/absence EPT data alone does not yield a good assessment of the relative importance of the EPT community in these two samples. Another method is to compare the proportion of the total sample composed of EPT organisms at the two stations. I excluded individuals from the hydropsychid caddisfly taxa in this comparison as hydropsychids are net-spinning filter feeders which often increase dramatically when there are the right types of particular organic matter present (e.g., downstream of sewage treatment plant discharges, or downstream of impoundments). Non-hydropsychid EPT organisms composed 23.6%, 18.2% and 28% of the reference station samples; they account for only 10%, 4.7% and 4.5% of the test station community. Using the Mann-Whitney U test, we reject the hypothesis that the mean abundance of this group of organisms is the same in the samples taken from these two stations. We accept the alternate hypothesis that the proportion of the non-hydropsychid community in the test station sample is significantly lower than that in the reference station sample.

If we investigate the EPT taxa lists further, we can find other differences. For example, Plecoptera taxa were found in all three reference station samples but none were found in test station samples. Heptageniid mayflies were found in two of the reference station samples, but this taxon was not found in the test station samples. In addition, heptageniids were seen in abundance on the bottom surfaces of the cement blocks that held the Hester-Dendy samplers at the upstream station, but were not seen at all on the samplers from the test station.

Community-level differences are evaluated on a wider scale through the Community Similarity Index. Values for this index from reference station and test station samples were significantly different, based on the Mann-Whitney test. In addition, based on RBP scoring criteria, they are substantially different as well. The similarity between test and reference station samples ranged from 0.26 to 0.41 and averaged only 0.33 for all nine test:reference station comparisons. By comparison, the similarity between each of the three samples collected at the reference station ranged from 0.84 to 0.93 and averaged 0.86. These results indicate that a) all three of the reference station samples exhibit a high degree of similarity in the relative abundance of different taxa collected; and b) each of the three test station taxa lists is substantially different from each of the reference station taxa lists.

Since the community changes between these stations are dramatic, and because they result in a community that is much more tolerant of low oxygen conditions than that seen at the reference station, I feel that the MODERATE IMPACTS judgement is substantiated. Since the sampling bracketed the discharge so closely, in my opinion these impacts are a direct result of the Crane Paper discharge.

Pittsfield POTW: Results of the Pittsfield POTW evaluation (Table D-3B) yielded an 85% degree of comparability between reference and test stations. This value yields a judgement of NO IMPACT for the site.

Differences in RBP metric scores were minimal and were seen in the Biotic Index, the EPT Index and the Community Similarity Index. Although the Biotic Index values from the test station sample averaged higher than those from the reference station and were also significantly higher based on the Mann-Whitney test of means, the metric means differed by only 12%. This difference is small enough so that Biotic Index values are not considered to be substantially different based on EPA criteria for this metric. Conversely, the mean EPT metric score from the test station was lower than that at the reference station by a value (about 20%) that was great enough to yield a penalty for this metric based on EPA criteria.

However, EPT metric scores from the two stations were not judged to significantly different when evaluated by the Mann-Whitney U test.

The Community Similarity Index was the only metric for which both statistically significant changes as well as changes meriting a loss of RBP points were observed. Scores from the reference:test station comparisons ranged from 0.55 to 0.78 and averaged about 0.67. Differences between stations in two taxonomic groupings appear to be responsible for the depressed Community Similarity Index values. Leptophlebiids, which are consistently represented (11-14% of the total sample) in the reference station samples, all but disappear at the test station (1-2% of the total sample). Leptocerids, also well represented in the reference station samples (between 6.5 and 10.5% of the total sample) were completely absent from the test station sample. The first group are gathering-collecting taxa; the second group are predators. Even with these differences, there did not appear to be a major shift in functional feeding groups between the two sampling sites.

In my opinion, differences seen in the taxa lists are fairly minor, and the NO IMPACT assessment is valid for the data collected. However, it should be noted that our test station samplers were not always in the direct path of the discharge plume. As a result, we probably did not assess the full effect of the discharge on the macroinvertebrate community at this site.

Schweitzer Mauduit: The test station for this evaluation was considered MODERATELY IMPACTED compared to the reference station at this site (see Table D-3C). Major differences in the taxa list fall into several categories.

The chironomid component of the samples rose from 37% in the reference station sample to 74% in the test station sample. A change of this magnitude is substantial and is evidence that environmental conditions at the two stations are quite different. Since the habitat scores were nearly identical at the two stations bracketing this facility, I expect that this difference is primarily a result of the discharge.

The EPT Index was 50% lower at the test station than it was at the reference station. Those EPT taxa (four in number) which were well represented in the reference station sample were all seen in the test station sample, however. There were an additional four rare EPT taxa (only one individual per taxon) in the reference station sample that were not seen in the test station sample. In my opinion, the difference in number of EPT taxa between these two stations is not that damaging to the community as a whole as the differences were due to a loss of rare taxa and some of this loss might be expected from routine sampling error. However, if we look at the total EPT community presence at the two stations we see that the relative importance of this community has also been diminished at the test station. The component of the sample comprised of EPT taxa in the test station sample was quite small, only 19%. By comparison, the EPT community in the reference station sample comprised 40% of the total sample.

The relative importance of the scraper guild in the samples is quite different. Scrapers account for 17.4% of the reference station community, but only about 6.6% of the test station community. Scrapers feed on periphyton which grows on benthic substrates. They are an important component of the riffle community in larger, unimpacted streams that have an open canopy and receive a lot of sunlight. Both the reference and test stations were located in riffles that had open canopies and were wide enough to receive sunlight much of the day. I postulate that the turbidity at the test station was great enough to impede sunlight penetration to benthic substrates, thus impairing natural periphytic growth.

There is also a major downward shift in the representation from hydropsychid caddisflies at the test station. As mentioned above, hydropsychids are filter-feeders that trap and harvest organic particulates from the water column. I had expected to see a rise in this group at the test station, similar to that seen downstream of sewage treatment plant discharges where organic particulates in the discharge have increased turbidity. The turbidity in the Schweitzer Mauduit discharge and that downstream of the plant may not be organic, however, and may be due to clays used in certain paper products.

In summary, there has been a community alteration at this site, which I expect is most probably a result of the discharge. The chironomid component of the community has been dramatically increased, EPT decreased and the scraper functional group has been replaced by other functional groups. All of these

changes are considered detrimental to the biological integrity of the macroinvertebrate community in the Housatonic.

Great Barrington POTW: This assessment yielded a judgement of MODERATE IMPACTS for the test station (see Table D-3C). Although the Percent Comparability (64%) of reference and test stations is similar to that (62%) at the Schweitzer Mauduit site, I would say that the changes to the benthic community at the Great Barrington site were less substantial than those at Schweitzer Mauduit or Crane, and are in part, attributable to habitat differences.

There were no drastic changes in the makeup of the benthic community sample at the Great Barrington test station relative to that from the reference station. This is partly due to the fact that the dominant organism in each of the taxa lists accounts for only 24% of the sample from the reference station and 26% from the test station. There were some changes in taxa lists between reference and test stations at the Great Barrington site which account for the lower than optimal score in Community Similarity. The largest changes in numbers of individuals within taxa between stations occur in the heptageniids (6/1 as reference/test); in the ephemerellids where there is a complete loss downstream (6/0); a drop in hydropsychids (19/9) and increases in black flies (4/11) and chironomids (8/24).

The test station also lost points for other metrics: the Biotic Index and the EPT Index. The Biotic Index ratio of reference:test station for the Great Barrington dataset was about 84%. Since a value less than 85% receives a penalty, this metric score is nearly the same as scores that are not penalized. The change in EPT was partly due to a loss of ephemerellids, which is notable, but also was due to a loss of one rare taxon (1 individual). Differences between stations in a few rare taxa are expected.

I am concerned that some of the changes between these two stations may be due to differences in conditions upstream of each of the stations rather than with the discharge *per se*. As mentioned in the Site Descriptions, the riverbanks directly upstream of the test station were vertical, completely denuded of vegetation and had a high likelihood of eroding during high water. By comparison, the riparian zone upstream of the reference station had a high degree of stabilization, both natural and man-made.

I will emphasize that the colored discharge from this facility, discussed in the Site Descriptions section, is a violation of Massachusetts Water Quality Standards. I have not seen a discharge with this intensity of coloration since I began work with the state in 1980. This condition should not be allowed to persist and should be controlled through the NPDES permit in the next cycle of permitting.

LITERATURE CITED

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Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, R.M. Hughes. 1989. Rapid Bioassessment Protocols for Use in Streams and Rivers, Benthic Macroinvertebrates and Fish. United States Environmental Protection Agency. Office of Water (WH-553). EPA/444/4-89-001. May 1989.

Table D2. Taxa List for Macroinvertebrate surveys conducted at stations upstream and downstream of select NPDES discharges in the Housatonic River Basin, September and October, 1997. Notation for stations is as follows: GB = Great Barrington POTW; SM = Schweitzer Mauduit; P = Pittsfield POTW; C = Crane Company. Up refers to upstream (reference) station, dn refers to downstream (test) station. Numbers 1, 2, 3 refer to sample numbers where Hester-Dendy samplers were used. FFG = functional feeding group. Categories include GC (gatherer-collectors), SC (scrapers), FC (filtering collectors), PR (predators) and SH (shredders). TOLVAL refers to the tolerance value of the taxon on a scale of 0-10. A taxon with a value of 0 is very intolerant to low dissolved oxygen and presence of organic wastes; a taxon with a value of 10 is very tolerant.

TAXON	FFG	TOLVAL	GBup	GBdn	SMup	SMdn	Pup1	Pup2	Pup3	Pdn1	Pdn2	Pdn3	Cup1	Cup2	Cup3	Cdn1	Cdn2	Cdn3
Mollusca																		
Gastropoda (snails)																		
Basommatophora																		
Physidae	GC	8					1					2				3		9
Planorbidae	SC	6															1	
Ancylidae (limpets)	SC	7		1		2					1	1		3	1	9	4	4
Pelecypoda (bivalves)																		
Veneroida																		
Pisidiidae (fingernail clams)	FC	6	2															
Annelida (worms)																		
Oligochaeta (aquatic earthworms)																		
Tubificida																		
Tubificidae	GC	10								1								
Naididae	GC	9					2	1	4	2	5	5				35	65	51
Lumbricina	GC	8				1										5	10	10
Hirudinea (leeches)	PR	7																
Rhynchobdellida																		
Glossiphoniidae	PR	7														6		
Arthropoda																		
Crustacea																		
Amphipoda (scuds)																		
Crangonyctidae	GC	8								1	4							
Hyalellidae	GC	8				1							4	5	7	5	4	5
Arachnoidea	PR	6	1	1	1	1		1	1									
Insecta																		
Ephemeroptera (mayflies)															1			
Baetidae	GC	4	10	15	7	8									1			
Oligoneuriidae	GC	4		1											2			

Table D2. Continued. Taxa List for Macroinvertebrate surveys.

Heptageniidae	SC	4	6	1	3	3	20	24	24	24	36	39	5		2			
Ephemerellidae	GC	1	6		1				1				3	4	3	6	2	2
Caenidae	GC	7	2	4	4	4	1											
Leptophlebiidae	GC	2					12	14	12	2	1	1	13	12	7	4	1	1
Odonata (dragonflies and damselflies)																		
Zygoptera (damselflies)																		
Calopterygidae	PR	5							1									
Coenagrionidae	PR	9														1		
Plecoptera (stoneflies)																		
Taeniopterygidae	SH	2					5	10	4	5	2	1	3	2	9			
Perlidae	PR	1			1													
Trichoptera (caddisflies)																		
Philopotamidae	FC	3	4	2														
Psychomyiidae	GC	2	1								1							
Polycentropodidae	FC	6					5	5	2	1	5	5	1		2		1	1
Hydropsychidae	FC	4	19	9	20	5	6	16	7	13	18	2						
Glossosomatidae	SC	0	2		1													
Hydroptilidae	GC	4	2	1	1													
Leptoceridae	PR	4					7	9	11				1	2	1		1	1
Lepidoptera (butterflies and moths)																		
Pyralidae	SH	5																
Coleoptera																		
Elmidae (riffle beetles)	SC	4	23	17	12	2	1			1								
Psephenidae	SC	4		1														
Diptera (true flies)																		
Tipulidae (crane flies)	SH	5	2		5						2							
Simuliidae (black flies)	FC	6	4	11		2												
Chironomidae (midges)	GC	6	8	24	34	73	47	22	38	44	25	38	80	82	64	26	17	26
Athericidae	PR	2	1	3														
Empididae	PR	6	2	1	2		1											
Total # of Organisms			95	92	92	102	108	102	105	94	100	94	110	110	100	100	106	110
Total # of Taxa			17	15	13	10	12	9	11	10	11	9	8	7	11	10	10	10

Table D-3A. Summary of RBP II data analysis for macroinvertebrate communities sampled in the Housatonic River basin, upstream and downstream of the Crane Paper discharge. Invertebrates were collected from Hester-Dendy samplers. Biological metrics were calculated for the three invertebrate samples collected at each station. The mean metric score was used to evaluate the RBP II criteria for determining potential impairment. The percent comparability of the downstream (test) station to the upstream (reference) station yields a final impairment score for the test station. Potential Impairment Categories in the RBPII analysis are: None (no impairment), Moderate and Severe. The Mann-Whitney U test (1-tailed, α= 0.05) was used to evaluate the hypothesis that the metric values from the downstream station were no worse than those from the upstream station.

SAMPLE #	Cup1	Cup2	Cup3	MEAN	SCORE ON MEANS	Cdn1	Cdn2	Cdn3	MEAN	SCORE ON MEANS	MANN WHITNEY U STATISTIC
STATION AND DESCRIPTION	21-EBH01 UPSTREAM OF CRANE PAPER					21-EBH02 DOWNSTREAM OF CRANE PAPER					
TAXA RICHNESS	8	7	11	8.7	6	10	10	10	10	6	NS
BIOTIC INDEX	5.25	5.39	5.18	5.27	6	7.03	7.99	7.72	7.58	3	Significant
EPT INDEX	6	4	8	6	6	2	4	4	3.33	0	NS
EPT/CHIRONOMIDAE	0.33	0.25	0.44	0.34	6	0.38	0.29	0.19	0.29	6	NS
SCRAPERS/FILTER-COLLECTORS	5	3/0*	1.5	3.3	6	9/0*	5	4	4.5	6	NS
% DOMINANT TAXON	73%	75%	64%	71%	0	35%	61%	46%	47%	3	NS
COMMUNITY SIMILARITY (CC) INDEX**	U1:U2=.93	U2:U3=.82	U3:U1=.84	0.86	6	U1:D1=.36 U2:D1=.41 U3:D1=.39	U1:D2=.29 U2:D2=.26 U3:D2=.26	U1:D3=.32 U2:D3=.35 U3:D3=.34	0.33	3	Significant
TOTAL METRIC SCORE					36				27		
% COMPARABILITY TO REFERENCE STATION						75%					
DEGREE IMPAIRMENT						MODERATE					

*3/0 and 9/0 refer to the abundance of scrapers/filter collectors in the samples. Division by zero produces a mathematically undefined value; these entries were not used in the analysis.
**U1..U3 refers to Cup1..Cup3; D1..D3 refers to Cdn1..Cdn3. Notation as in Table 2.

Table D-3B. Summary of RBP II data analysis for macroinvertebrate communities sampled in the Housatonic River basin, upstream and downstream of discharges from the Pittsfield WWTP. Invertebrates were collected from Hester-Dendy samplers. Degree impairment was evaluated as described in Table 3A.

SAMPLE #	Pup1	Pup2	Pup3	MEAN	SCORE ON MEANS	Pdn1	Pdn2	Pdn3	MEAN	SCORE ON MEANS	MANN Whitney U STATISTIC
STATION #	21-HR01 UPSTREAM OF PITTSFIELD WWTP					21-HR02 DOWNSTREAM OF PITTSFIELD WWTP					
TAXA RICHNESS	12	9	11	10.67	6	10	11	9	10	6	NS
BIOTIC INDEX	4.82	4.13	4.65	4.53	6	5.02	4.98	5.26	5.09	6	Significant
EPT INDEX	7	6	7	6.67	6	5	6	5	5.33	3	NS
EPT/CHIRONOMIDAE	1.19	3.5	1.61	2.1	6	1.02	2.52	1.26	1.6	6	NS
SCRAPERS/FILTER-COOLECTORS	1.91	1.14	2.67	1.91	6	1.79	1.61	5.71	3.04	6	NS
% DOMINANT TAXON	44%	24%	36%	34.7%	3	47%	36%	42%	41.7%	3	NS
COMMUNITY SIMILARITY (CC) INDEX	U1:U2=0.73	U2:U3=0.79	U1:U3=0.85	0.79	6	0.78 0.68 0.74	0.59 0.7 0.63	0.71 0.55 0.69	0.67	3	Significant
TOTAL METRIC SCORE					39					33	
% COMPARABILITY TO REFERENCE STATION	100%					85%					
DEGREE IMPAIRMENT						NONE					

Table D-3C. Summary of RBP II data analysis for macroinvertebrate communities sampled in the Housatonic River, upstream and downstream of discharges from the Great Barrington WWTP and Schweitzer Mauduit. Only one sample was taken at each of these stations using kicknets. Biological metrics for these samples were calculated and scored according to RBP II criteria. The percent comparability of each downstream (test) station to respective upstream (reference) stations yields a final impairment score for each test station.

Station and Description:	21-HR03 Upstream of Schweitzer Mauduit		21-HR04 Downstream of Schweitzer Mauduit		21-HR05 Upstream of Great Barrington WWTP		21-HR06 Downstream of Great Barrington WWTP	
METRIC	Metric Value	Score	Metric Value	Score	Metric Value	Score	Metric Value	Score
TAXA RICHNESS	13	*6*	11	*6*	17	*6*	15	*6*
BIOTIC INDEX	4.9	*6*	5.7	*6*	4.1	*6*	4.9	*3*
EPT INDEX	8	*6*	4	*0*	9	*6*	7	*3*
EPT/CHIRONOMIDAE	1.1	*6*	0.3	*3*	6.5	*6*	1.4	*0*
SCRAPERS/FILTER-COLLECTORS	0.8	*6*	1.0	*6*	1.1	*6*	0.9	*6*
% DOMINANT TAXON	37%	*3*	74%	*0*	24%	*6*	26%	*6*
COMMUNITY SIMILARITY	100%	*6*	59%	*3*	100%	*6*	61%	*3*
TOTAL METRIC SCORE		*39*		*24*		*42*		*27*
% COMPARABILITY TO REFERENCE STATION			62%				64%	
DEGREE IMPAIRMENT			MODERATE				MODERATE	